American Machinist

Established 1877
McGraw-Hill Publishing Company, Inc.

New York, November 5, 1931

The cost of diemaking is an important factor in stamping. It can often be reduced by careful engineering

Tool Economy Through Adjustability

J. L. PETZ
Tool & Production Engineer, Electromatic Typewriters, Inc.

TOOLING for any manufacturing process depends upon the type and quantity of the product. A high production plant, making large quantities of identical parts, may be justified in installing fully automatic and sometimes single-purpose machines, which require only a fraction of the operator's attention. A job shop, having only one part of a kind to produce, must usually resort to toolroom methods of layout and machining.

Between these two extremes fall a great majority of manufacturing operations. A fine sense of judgment and familiarity with production economies is needed to decide just how far tooling should be carried for a given product.

The solution of this problem by Electromatic Typewriters, Inc., illustrates what may be done toward putting the product on a quality production basis without excessive tool costs. It was found possible to design many of the diesets so they could be used on a number of similar parts by the adoption of certain adjustable features.

The best example of the application of this principle lies in the manufacture of bell cranks for the electrically operated typewriter made by this concern. These parts form connecting links between the key levers and the type bars. Because the type bars are arranged on a curved pivot bar, and the bell cranks which operate these bars are on a straight pivot bar, the arms on the bell crank which transmit the same movement to each type bar must all be of different lengths and different forms. To make these separately would require a complete set of punches and dies for each letter key or 42 sets in all. But by the employment of adjustable dies, the total number of tools required is drastically reduced.

Two basic sets of blanks are required because of a difference in the curvature of the lower arm necessitated by a change of position in alternate driving links. For identification, one of these groups is designated by even numbers and the other by odd numbers. Fig. 1 shows the even numbered bell cranks which will be observed to have several variable dimensions. Tabulated dimensions are given for only two parts, but the differences in these will serve to indicate the wide range of sizes called for. Ten of the parts are formed right-handed and eleven left handed. For each even-numbered part, there is a corresponding odd-numbered part, the variation being in the position of the center of the 1.875 in. radius which scribes the lower arm. So altogether, there are many variables to take care of in the tooling. Although two sets of blanks would make all the bell cranks, as shown by the heavy dotted lines in Fig. 1, for economy in stock,

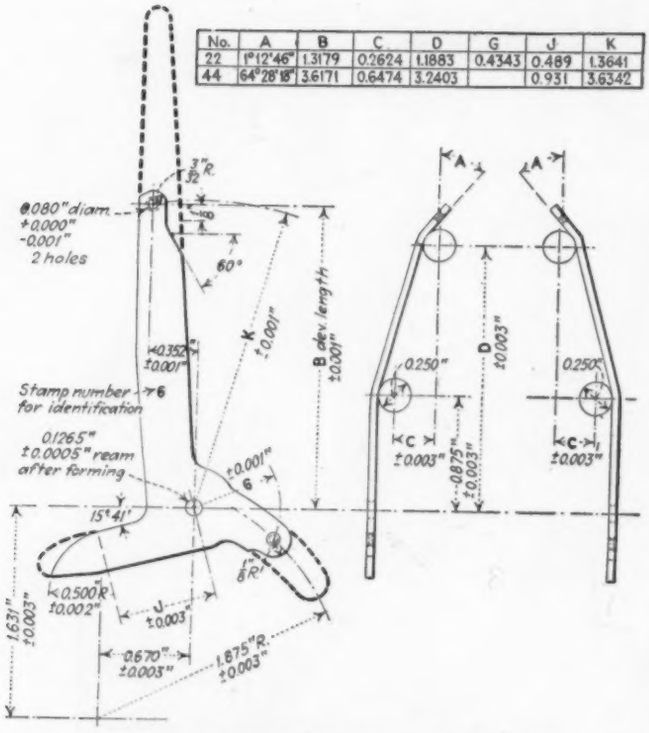


Fig. 1—Seven varying dimensions on 42 different bell cranks present a problem in die adjustment if independent diesets for each are to be avoided

two sizes are made for both the even- and odd-numbered parts.

A conventional compound die blanks the bell crank and punches the center hole for the first operation. The parts are then numbered and kept in separate boxes for the subsequent steps. The first variable is introduced in trimming the long arm and perforating the hole in its end. For this work, the adjustable die illustrated in Fig. 2 is employed.

The blank is nested over locating pin *C* and forced counterclockwise by a spring lever against the nest plate. Section *B-B* shows in detail the arrangement of the punches, dies and locating pin. The heel of the large trimming punch enters the die opening first thus securing adequate support. Next the perforating punch *G* completes its work and is followed by the shearing edge of the trimming punch *F*. During these operations, the blank is held securely in place by a pressure pad which also acts as a stripper. It will be noted that the die is split along the line *J-J*, which separates the locating pin and spring lever from the operating half. Any adjustment in the sliding member alters the distance between the locating pin and the points of contact of the punches, thus controlling dimension *B* in Fig. 1. A key, 1¼-in. wide, guides the locating half of the die, and the bolts *L*, passing through elongated slots, secure it in place.

The die is set by using a micrometer to measure dimension *A* over the lugs provided for that purpose. This distance is exactly 1.000 in. for the smallest bell crank and is increased proportionately for the longer pieces. The die opening is, of course, made sufficiently long to accommodate the ends trimmed off the shorter blanks. Since the lower arm is not used for location in this tool, either odd- or even-numbered blanks may be run through without special provision. Otherwise, the die follows standard practice as may be seen from the illustration.

The next step is somewhat more complicated. It consists of trimming and perforating the lower arm which varies in length along a radius equal to the driving link. As noted previously the center of this radius differs for the odd- and even-numbered bell cranks.

As before, the operating portion of the die is fixed, leaving a solid support for shearing the metal. The two holes previously punched are used to locate the blank over pins *A* and *B* for odd-numbered parts. The adjustable member, which carries these locating points, is pivoted at pin *C*, and its angular position is read on scale *D* graduated in part numbers instead of degrees. Since these numbers are already stamped on the blanks, the operator need not refer to the drawing when setting the die. The swiveling member is clamped by the bolts *E*, which pass through elongated slots. The portion of the blank to be trimmed extends over the die opening *F*. As the swivel is pivoted counterclockwise, the arm is left longer. The punched hole remains in a fixed position to the end of the arm.

Two more locating holes *G* and *H* for even-numbered parts, take care of the difference in radius in the arm being trimmed. Pin *B* is removable having a slip fit in the swivel and may be transferred to position *H*. Pins *A* and *G* are mounted in adjustable slides to accommodate the variable lengths of the lower arms. One of these slides, consisting of two grooves on opposite sides of the swivel plate and a connecting slot, is shown in section *J-J*. The distances between pins *A* and *B*, or *G* and *H*, may be set from the blanks themselves.

The punch is provided with a heel to insure firm support before it strikes the work as shown in the sectional view. The pressure pad and other details of the dieset conform to standard practice.

Fig. 4 shows the next dieset, which shaves the ½-in. radius. This die is split similarly to that in Fig. 2, the adjustable half being locked by bolts *A* and kept in alignment by key *K*. The variable dimension to be considered is *J* in Fig. 1, the distance between the center hole and the center of the ½-in. radius.

As before, two of the holes previously punched provide the locating points, the blank nesting over pins *B* and *C*. Pin *B* is stationary in relation to the slidable half of the die, but pin *C* is mounted on slide *D* having a straight line adjustment. This may be set directly from the perforated holes in the work, and locked by the bolt *E*. Gaging points are secured to the two halves of the die at *F* and are so placed that they measure 1 in. plus the variable dimension *J*. The setting may thus be quickly made with a micrometer or snap gage without computation. Section *L-L* illustrates the arrangement of gaging points and one locating pin. As in the other adjustable diesets, the die proper is firmly fixed to the shoe.

The last dieset performs the forming operation. Since the angles at both ends of the bell cranks are variable, it was not considered practical to make these dies adjustable. Accordingly upper and lower blocks were made for each angular variation and were adapted to fit a standard pair of shoes. Tongues in the dies fit grooves in the shoes, and the endwise location is fixed by pins *A*. Clamps *B* hold the upper and lower die blocks rigidly.

Each dieset will form one odd- and one even-numbered piece. The blanks are located at one end by pins fitting the center hole and at the other by two pins which bear

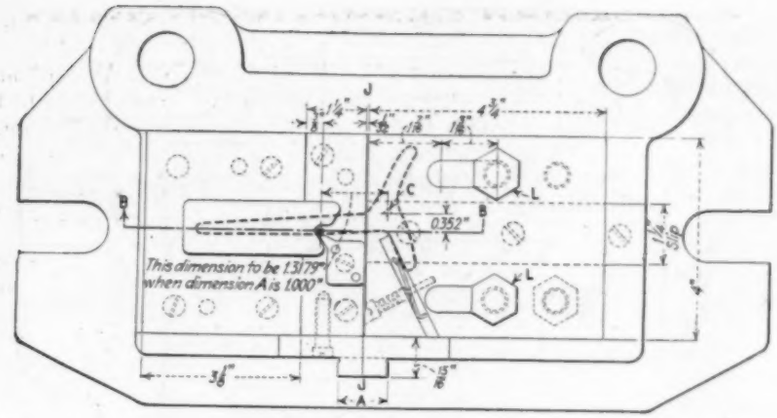
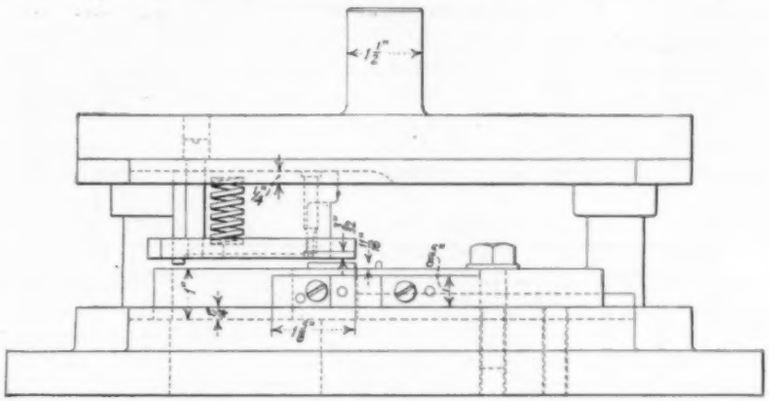
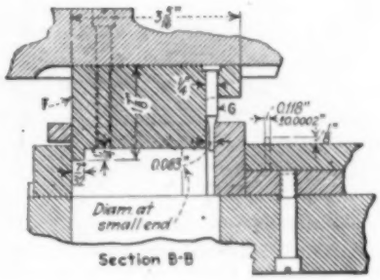


Fig. 2—A work-supporting slide controls the point of cut-off and perforation for the upper arm





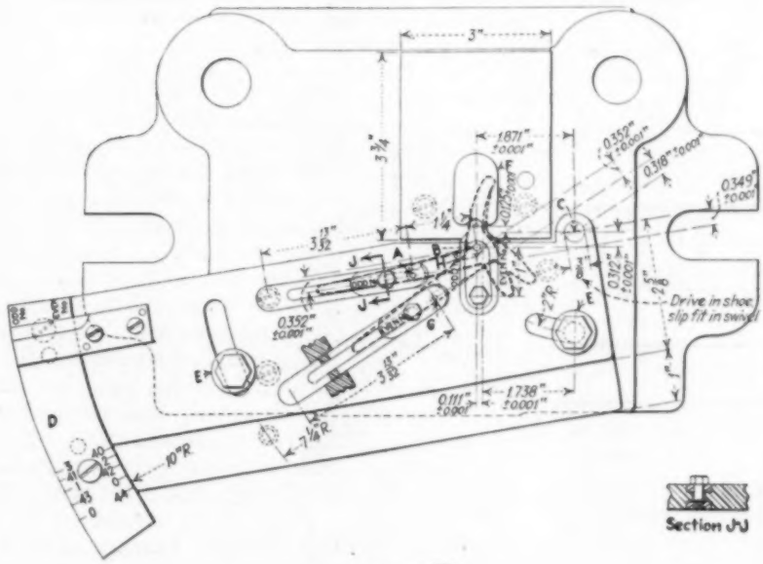
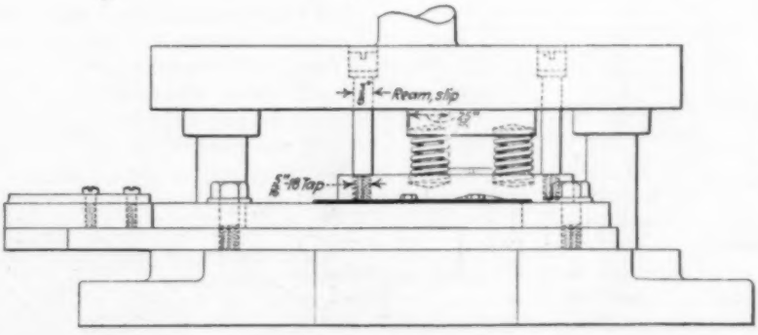
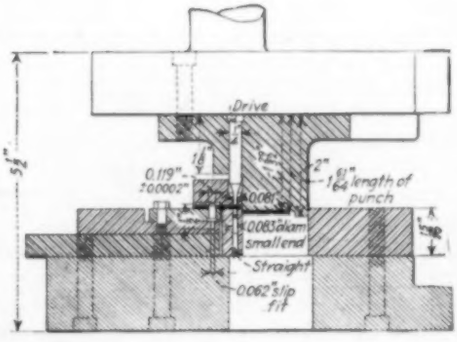


Fig. 3—An unusual die design results from the combined straight-line and angular adjustment needed to trim and perforate the lower arms to varying dimensions





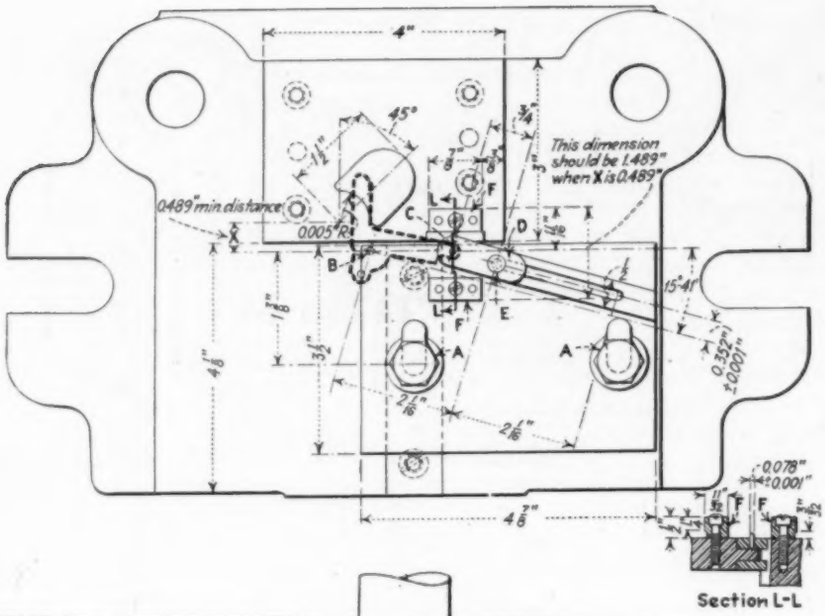


Fig. 4—Two linear adjustments are required in this die, one to locate the work by holes previously perforated and the other to control the trimming of the radius. The dimension over blocks F gives this last setting

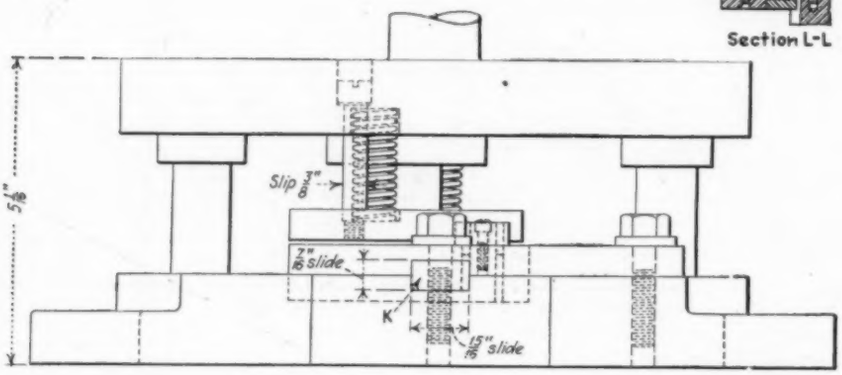
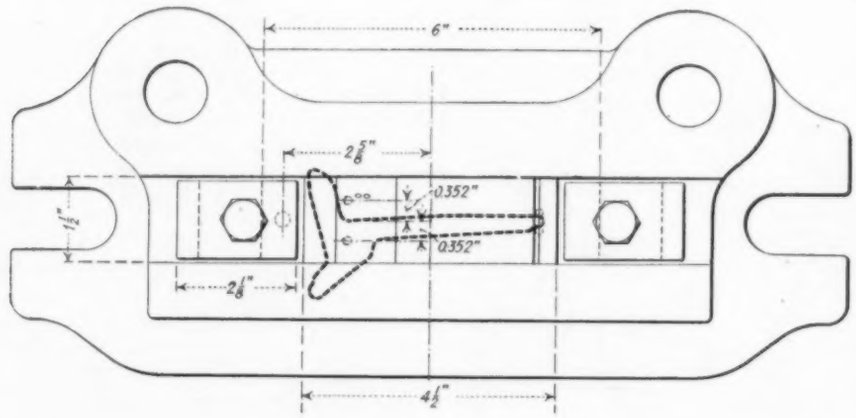
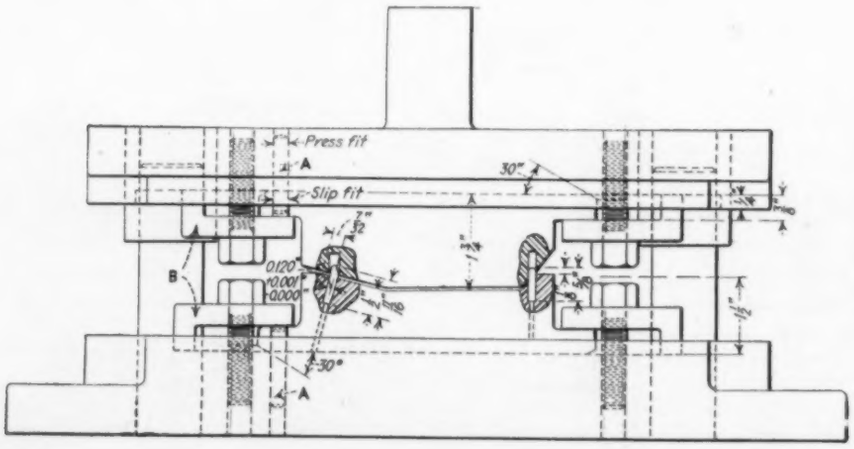


Fig. 5—Separate die-blocks are clamped in standard shoes for the forming operation. Each set accommodates a right- and left-hand bell crank. The forming angle is experimentally determined to compensate for spring in the work





against either side of the end radius of the long arm. Since odd-numbered parts are, in each case, of the opposite hand from the even-numbered parts, each dieset is provided with two pins for locating the center hole. The locating pins are so formed that they will not bind in the holes as the part takes its shape. The die-blocks are made to angles in excess of the obtuse angles specified on the drawing of the part. This added bend is determined experimentally and compensates for the spring of the piece. For these and the other tools described, standard Danly diesets are used.

From these details, it is evident that the total number of dies necessary to manufacture forty-two different bell cranks has been reduced far below the requirements for stamping each piece separately. The change-over of any die can be quickly made, and the method of setting is effected so simply that the chances of error are negligible. This is another example of careful design resulting in a wider range of usefulness and great tool economies.

Experiences with Vibration

HARRY SHAW
Consulting Engineer,
Lancashire, England

IT IS generally stated that vibration can be cured by making a machine heavier or more rigid. This may be so in some instances, but not in others. The writer has seen vibration in gear cases or boxes cured by tightening the cover a little more, also by loosening the fastening bolts slightly.

Similarly he has seen vibration reduced by tinning the inside of a cover or machine body and casting lead ribs on, but on the other hand he has seen vibration cured by cutting a hole in a rib. One particular instance of this enigmatical subject he vividly remembers.

The body of a machine of new design was made from steel plates welded together. When running, that machine gave off a deep note, and the man in charge became quite expert at playing a tune by pressing with a hammer head on different parts of a panel, the effect of this being to stop the tune altogether or vary its tone.

This noise from the machine was cured by drilling a small hole in the center of every large panel, which presumably had the same effect on the machine as putting a hole in the skin of a drum.

Vibration in large surfaces can be reduced in period by breaking the surface up by ribs or holes.

If a casting is twisted, such as a cover might be by being tightened onto an uneven bed, the material is tensioned and this produces in the casting the same effect as is produced in the string of a musical instrument by extra tensioning. If a string is tensioned and we strike it we get a higher note than we would from an untensioned string. Hence vibration will produce a higher note in a tensioned casting than in an untensioned one, so that one of the cures for noise from a cover is to loosen the fastening bolts slightly, to make a better bed for the cover by machining the faces more accurately, to insert lead strips between the joints, or to use the three-point method of bedding.

Certain high-speed sensitive-drilling machines when bolted tightly to their foundations vibrated greatly. When the bolts were loosened a little the vibration ceased. Vibration in a milling machine cutter was cured by hanging a weight on the milling machine overarm.

In a large cotton mill in Lancashire large sheets of glass stretching from floor to ceiling are arranged in staggered formation to baffle the draught from running belts and so to prevent it from breaking the cotton passing from one machine to another. The vibration from the machinery caused these sheets to break continually, and even the insertion of rubber between the glass and the frame did not prevent it. When a $\frac{1}{4}$-in. bolt with a washer at either side was placed in a hole drilled in the center of the sheet, vibration and breaking ceased.

When vibration takes place in machines themselves it can generally be stopped by one of the several methods mentioned; but when it takes place in the work the problem is more complicated. It is not often feasible to cast ribs on or cut holes in work, or even to grip the work more securely.

At one time the writer lived about two miles from a plant that was working at night. Night after night he was kept awake by a terrible whining sound. Finally, in desperation, he decided to visit the plant—he was friendly with the manager. A number of copper drums about 6 ft. in diameter and 8 ft. long were being turned. The noise given off was very high pitched so that most of the men in the department had cotton wool in their ears. Attempts had been made to stop the noise by varying the cutting speed and shape of tool, packing the tool on wood, gripping the work more firmly, etc., but without success. At the writer's suggestion the drum was one third filled with water and the noise lessened considerably. Partly filling the drum with heavy machine oil completely stopped it.

Noise produced during drilling operations on some large tanks was nearly deafening the whole works, but could not be prevented by filling the tanks with oil, so another dodge was tried. A bracket, fitted with a shaft that had a pulley at one end and a flat disk at the other, was bolted to the tank. A belt from an overhead shaft was connected up to the pulley of the apparatus and the flat disk driven at a high speed. A weight was adjustable across the plate so as to unbalance it. This out of balance of the disk set up a vibration that destroyed the vibration set up by the drilling. This fixture is in regular use.

The above method of vibration prevention can often be used, for frequently vibration is only caused by the different vibrations of all the parts synchronising. Destroy this synchronism by reducing or increasing the weight of a part and the effective vibration will disappear.

Silver Solders and Nickel—*Discussion*

A. EYLES
Foreman, Sheet Metal Working Dept.,
London, Midland & Scottish Railway Co.

In the fabrication of nickel and Monel metal products and components mentioned under the title above (*AM*—Vol. 74, p. 870), experience proves that superior brazing is done with silver solders. Many shop managements associate high cost with silver solders; actually, however, because of the sparing way in which they are used, and since joints require little finishing, these solders are very economical to use, in fact, are probably the cheapest jointing materials for a number of uses.

One thing to remember in silver soldering is to remove the torch flame as soon as the brazed joint is completed, and then immediately to immerse the piece in cold water. By thus doing, the flux is disintegrated—if the brazed joint is allowed to cool slowly the flux usually sets into a hard vitreous film difficult to remove. A little sulphuric acid added to the water used for quenching greatly assists removal of the flux and scale. Joints may be cleaned by filing, grinding or polishing, and then may be burnished if necessary.

The Foreman's Round Table

Muzzling the Press

"HELLO, Al." It was Ed's voice on the wire. "Say, did you hear anything about Joe Cook being let out?"

"No, Ed," answered Al, "I didn't. Why—did you?"

"Yes, I rode home with Aleck James tonight, and he told me it was all over the shop. I thought you might know something."

"I haven't heard anything about letting him out, but I understand that Williams objects strongly to his line of talk."

"I think Williams is wrong. He's just plain narrow minded."

"Maybe so, Ed, but tell me, why it is so much more narrow minded for Williams to object to Joe Cook's opinion about what he does than for you and others to object to Williams' opinion of what Joe Cook does? And yet you think you are liberal and Williams is narrow minded."

"Well, Williams is a boss and is taking advantage of his position."

"You're wrong there, Ed. Williams is liberal. Did you ever know him to squelch a shop lawyer? We have one or two who criticize everything that happens or doesn't happen. They will argue for an hour on whether a man is at work when he punches the time clock, or when he starts his machine."

"I know that, Al, and it makes me wonder why he talks of firing Joe Cook and lets those loud mouths spout all they want to. A foreman has as much right to express his opinion as a machinist has."

"Sure! But, Ed, there is a big difference between the shop lawyer, who has an opinion on everything and seldom the same opinion twice on the same subject, and Joe Cook who has but a single opinion that influences his every act and utterance. In fact, Joe no longer has opinions, he has a state of mind."

"Boloney, Al, as your famous namesake says. Joe Cook is a good guy at bottom, and the constitution says you can't put a man in prison in this country for his opinions."

"Maybe not, but there are a lot of men in prison just because they put their ideas into operation. We all have a little monomania. Like the old Quaker, or was it a Scotchman, who said to his wife, 'All the world is odd save thee and me, and methinks at times thou art a little queer.' Well this monomania stuff may be mild like yours, or an obsession like Joe Cook's."

"Yeah, never mind any slams. I still think having a decided opinion is a sign a man has a brain, and I contend he shouldn't be fired or jailed."

"Maybe not, but opinions have a way of translating themselves into action at the most inopportune times. During the war, people were careful about advancing their pacifist beliefs as an excuse for not being drafted, and today the jails are filled with people who believed the income tax was wrong and acted accordingly."

"Yes, but what has that got to do with Joe Cook's case? He isn't a pacifist, and he hasn't enough income to have an opinion about."

"It means this. Joe has a right to his opinions but he has no right to impress the same one opinion upon his associates and inferiors, in season and out. He tries to override the opinion of everyone else, and at the same time, resents any one differing with him."

"Well, I still maintain that it's nobody's business what Joe thinks, but maybe I'd better not call Williams just now."

Free speech is a fine ideal, but how far does it go in actual practice? If a man's opinions are at odds with those of his employer, can he expect to have them overlooked, when he expresses them freely in the presence of others?

Discussion of Former Topics

Run-of-Mine

This discussion of Al and Ed on run-of-mine men opens up a very interesting field of discussion. It first shows the difficulty of picking good men even when the foreman himself has the selection, (employment men please take note) and also shows the poor caliber of men who apply for work in the shop. The class of the men who apply is influenced somewhat by the reputation a particular shop has among men, as to wages paid, steadiness of employment and how the men are treated. An average shop will get average men as applicants.

It is true that the average boy who has finished school and is looking for work looks for the so-called white collar job. Part, if not most of the time, this is the parents' fault.

During the last few years however, the white collar man in the shop has had a considerably better time of it from the wage standpoint. Almost invariably he works on a salary basis and works full time, while the shop man bears the brunt of shorter working hours as production falls off. While the rate per hour of the shop man may be higher, at the end of the year he has not earned as much as the clerical worker. Something needs to be done about this situation if better men are wanted in the shop.

There is no reason why clerical workers should work on a salary and have vacations with pay, any more than the man in the shop. Also, no reason why they should not feel the consequence of lessened production as well as the worker in the shop.

—P. W. Abbott.

Service or Ability

It is no exaggeration to say that at least eighty per cent of any concern's prosperity is due to the efforts of those employees, who by reason of service, have earned the right to be dubbed "oldtimers." This, in my opinion, entitles them to serious consideration when promotion is in the offing, and preference if of equal ability to the newcomer.

If, however, the new employee shows marked ability, which stands out from the routine methods of the oldtimer the executive who neglected such a valuable "find" would be failing in his duty to the company. At the same time, I am of the opinion that it would be unwise to promote the newcomer without scrutinizing his past record.

Continuity of employment, while a tacit acknowledgment of usefulness, should never be construed by any man as a guarantee of promotion. In the cold clear light of everyday business logic, ability, expressed in terms of constructive thinking and successful execution, is the yardstick by which a man's progress is measured and years of service do not directly enter.

—Robert S. Alexander.

Signing Off

Anything done regularly tends to become habitual, even unpleasant things. Signing, when done in quantities, is often done subconsciously and a short time afterwards, the man who appended his signature has no conscious recollection of what he signed. Fortunately, there is a subconscious faculty of noticing differences. A photo-electric cell will let thousands of usual and correct articles pass without comment or recollection. When an unusual one tries to pass a red lamp lights and a bell rings. The same is true of routine signing, at least with some individuals. If this faculty ceases to operate satisfactorily and too many mistakes are made it is time to bring forward some regulation which will make foremen sit up and take notice. —H. James,

Birmingham, England.

Service de-Luxe

Many men do not realize that, financially, their welfare is dependent upon their employer's well-being. In the main, their slogan is that they do not object to work providing the reward is adequate.

Many of these workers will prove their slogan to be more than idle talk. They will take advantage of the increased facility provided by the tool cribs. The majority of men using this opportunity will do so partly because of the piece rate and partly because of the requirements and obligations which are awaiting them at home. The number will be slightly increased by those few who suffer from a lust for gold.

One works in order to satisfy present requirements and to provide some security for the future. There are few workers today who are making a better pay than they have use for, so that there is every reason to expect the men who realize their responsibility to their dependents will do that little bit extra in the interests of others as well as themselves.

—D. Q Dunston,

Hutton-le-Hole, England.

Run-of-Mine

Tool makers and skilled mechanics are in the top class of mechanical workers. They have pursued their studies with a view to self improvement in their chosen trade. In a technical sense they have developed concentration, and acquired skill, knowledge and initiative. They are ambitious and loyal as a rule. In their elected field of labor they stand even with high grade men in any walk of life in their conception of professional or vocational duty.

The middle class of mechanical workers canot reach the level of the upper class of mechanical workers unles they pay the price, which they often cannot or more often will not do. They are not equally endowed with the spirit of application, ambition and study and possibly deficient in skill or constructive vision. This is equally true in the second class of workers in other occupations.

In the lower class of mechanical workers there are many misfits. Their standard of ethics is not so high as in classes Nos. 1 and 2, and they lack the essential qualities that spell advance. They comprise the clock watchers and shop idlers and are largely responsible for the heavy

labor turnover in shop operations. This class of indifferent workers exists in all other occupations. The machine shops are not the only sufferers, but they may suffer most.

Character, the spirit of loyalty, study, industry and ambition are the elements that develop useful lives without regard to occupation, and each individual worker must meet and answer his own problems and develop his individual life. This is not limited to machinists. Tool makers, clerks, divines, doctors, lawyers or merchants. They are all subject to the same law. —HOMER A. HERR, *President, Automatic Centrifugal Company.*

The law of average applies to shop workers as it does to other things, and the average shop worker is as good as the average office worker. There is no high average of potential C.P.A's among office workers, but clothes help a man's appearance. Perhaps he may look a little more "highbrow" with a good suit, well pressed, and a white shirt and collar fresh each day, as compared with a suit of overalls or dirty clothes. There is, and always has been, a fertile field for good help among shop workers, but it requires discernment to find men for responsible jobs. There should be a higher percentage of men with brains among shop workers today, because more boys are going through high school. Also, the urge to get more money to spend in enjoying life can be best met by factory work, which in a boy's estimation pays high wages for less effort.

Of course, if Al and Ed are in a line where only drudgery and low wages are offered, the average of brainy help will be low.

—JOHN S. ISDALE, *Plant Engineer, International Silver Company.*

Every shop, in the course of time, acquires a reputation as being a good or a poor place in which to work. In many, in fact in most cases, this reputation is caused by the rate of wages paid and the dependability of the job. Few expert mechanics are attracted to a job offering lots of overtime; nor do they apply for a job with a concern which is repeatedly hiring and laying off in an effort to adjust its force to the numerous peaks and low points in factory orders, rather than attempting to adjust its work load and delivery dates to the force available.

A certain shop, engaged in a highly competitive field, has for the past twenty years, to my knowledge, paid from 5 to 10 per cent higher wages than its competitors, and has received more than its share of the market. The best mechanics in the field were naturally attracted to this shop, for the reason that it offered steadier work at higher wages than its competitors. Every mechanic, fortunate enough to be employed, knew that there was always a number of other men anxious to take his place if he failed to produce. This shop did considerable field work, and though men in the field might not see a supervisor for two or more weeks, work started on the dot of 8 a.m., and tools were not laid down until 4 p.m.

The idea that the much-abused younger generation are afraid to get dirty is plain "hooey." Approximately 95 per cent of the apprentices in our service have had two or more years at high school, and they are a clever lot of boys.

It is my firm belief that most of the unskilled "strongbacks" in industry cannot be classed as mental or physical types. They are simply individuals who shun responsibility.

—ED. SEARLES, *Master Mechanic, Naval Aircraft Factory.*

Service or Ability

Length of service, as well as ability, must be considered in making promotions. This is the only policy that will tend to hold men on the job and thus reduce labor turnover. It will give them something to look forward to and help build up the morale of the organization. Of course the ability of the man is the more important factor, but he is entitled to and must receive credit for having stayed with the job. Every new man is an unknown quantity until he has demonstrated his ability over a reasonable length of time; a newcomer should not get undue preference over the old men.

When the general average of ability of the men is low there is very evidently something wrong with the policy of the management. A man worth hiring at all, is worth teaching in order to increase his ability. And the longer he stays the higher his ability should be and the greater his value. —L. O. BROWN.

Service or Ability

Long service gets a man into a rut, and his thoughts and actions take on the nature of an automatic machine which continually repeats the same functions in certain known cycles. A firm with this class of men can depend on certain results. Their continual and steady repetitions act as a steadying force, valuable in industry.

A new man's cycle of action is not known. He may introduce differences which are, if he is a good man, the best accumulations of a varied experience, differences which seem quite radical when compared with the functions of the long-service man.

The two classes of men do not mix without danger of friction. The long-service man is essentially conservative and the other is what may be termed a progressive radical. The best results are undoubtedly obtained from a mixture of the two. Each is valuable, but each becomes more so if the two work together smoothly. The promotion part of the question is entirely a matter which depends on the results to be obtained and the man to get the results.

—ARTHUR BRAMWELL.

Ability comes first in the selection of an executive. Loyalty is a good second, and length of service third. The three qualities go to make the real executive, and fortunate indeed is the firm when it secures an executive possessing all three qualities.

Any firm is justified in hiring an outsider for an executive position, providing the old timers have not developed the ability to handle a job higher up. Successful firms do this and the condition is as it should be. The automotive industry is probably exhibit A in this respect and is certainly a leader in earnings when compared with its length of existance.

The continuity of service idea, where length of service comes first and promotion follows after the death of a superior, has a tendency to retard initative, destroy efficiency, and cause a general slowing up among employes. A shop employing this method of selecting executives cuts itself off from a large field of prospects who may be more valuable than any in their own small circle.

When employees know that they have to compete for advancement with all other men in their line, they are more likely to be up on their toes and studying for the next higher job, instead of merely getting by until the boss dies. —C. F. STAPLES.

Standardization by Preferred Numbers

The use of certain geometrical progressions in engineering specifications results in a line of equipment consistent in size and capacity range. In addition, this practice correlates automatically similar products made by different manufacturers. Thus the foundation of a national standard is built into the original design, avoiding subsequent expensive readjustments

R. E. HELLMUND
Chief Electrical Engineer,

and

J. I. HOMMEL
Standards Division,
Westinghouse Electric & Manufacturing Co.

PREFERRED numbers are certain numbers which have been selected for standardization purposes to be used in preference to any others. These preferred numbers have been so selected that, starting with one and going either direction, they form a geometrical series advancing by even percentage steps and not by fixed amounts such as for an arithmetical progression. The advantages of a geometrical series are described in a paper by C. F. Hirshfeld and C. H. Berry on "Size Standardization by Preferred Numbers," (*Mechanical Engineering*, December, 1922, page 793). Normally, in the range of 10 to 100 for instance, we have 90 integral numbers to choose from, or if $\frac{1}{8}$ fractions are considered, 720 numbers are available. With such a wide variety of choice, there is little tendency toward standardization. The preferred numbers limit this choice by offering series of numbers as follows: the so-called 5 series, providing 5 steps between 1 and 10, 10 and 100, etc., an equal percentage apart of approximately 60 per cent; the 10 series, having 10 steps approximately 25 per cent apart; the 20 series, 20 steps 12 per cent apart; and the 40 sereis, 40 steps approximately 6 per cent apart. There is also an 80 series having 80 steps 3 per cent apart, but its use should be discouraged.

Table I shows the preferred numbers between 1 and 10 as recommended by the American Standards Association in bulletin Z-17 of 1927. The 5 and 10 series, which should be most commonly used, can be easily memorized from three numbers 1, 1.25, and 1.6. By simply doubling them, we obtain 2, 2.5 and 3.2; by doubling again, 4, 5, and 6.4, and doubling the first two of this last group, we finally have 8 and 10. The numbers thus found constitute the 10 series. For the 5 series, it is only necessary to drop every second member, thus obtaining 1, 1.6, 2.5, 4, 6.4, and 10. For numbers above 10, this series may be extended by multiplying each figure by 10, 100, etc. Below 10, the above numbers are divided by 10, 100, 1,000, etc., except that in a few cases a slight rounding of the last decimal is considered advisable to avoid too many decimal points. See Tables II, III, and IV for series 0.001 to 0.01; 0.01 to 0.1 and 0.1 to 1.0.

TABLE I

1 to 10				
5 Series	10 Series	20 Series	40 Series	Values to 5 Figures
	1	1	1	
			1 05	10592
		1.12	1 12	11220
			1 18	11885
	1 25	1 25	1 25	12589
			1 32	13335
		1 4	1 4	14125
			1 5	14962
1 6	1 6	1 6	1 6	15849
			1 7	16788
		1 8	1 8	17783
			1 9	18837
	2 0	2 0	2 0	19953
			2 1	21135
		2 25	2 25	22387
			2 35	23714
2 5	2 5	2 5	2 5	25119
			2 65	26608
		2 8	2 8	28184
			3 0	29854
	3 2	3 2	3 2	31623
			3 4	33497
		3 6	3 6	35482
			3 8	37584
4 0	4 0	4 0	4 0	39811
			4 25	42170
		4 5	4 5	44668
			4 75	47315
	5 0	5 0	5 0	50119
			5 3	53089
		5 6	5 6	56234
			6 0	59566
6 4	6 4	6 4	6 4	63096
			6 8	66834
		7 2	7 2	70795
			7 6	74990
	8 0	8 0	8 0	79433
			8 5	84140
		9 0	9 0	89125
			9 5	94405
10 0	10 0	10 0	10 0	100000

It should not be concluded that the mere use of any geometric series would tend towards standardization, nor that the use of the percentages indicated for the preferred numbers series alone would result in a useful standardization. It is an additional requisite to use the numbers themselves as given by the series to accomplish the desired results. For example, a series, consisting of the numbers 1.2, 1.9, 3, 4.8, 7.5, and 12, is a geometric series having approximately 60 per cent steps, but these are not preferred numbers, and therefore their use would not assist in bringing about the desired standardization.

The preferred numbers recommended by the American Standards Association are based on decimals. This fact has somewhat retarded the introduction of this system in this country, since it was sometimes found impracticable or inconvenient to use decimals on account of their lack of popularity, habit, or because tools and measuring instruments in the decimal system were not always available. Therefore the Westinghouse Electric & Manufacturing Company has found it desirable to work out an optional system of fractional preferred numbers, with the same percentage steps as the decimal series, namely, 60 per cent, 25 per cent, 12 per cent, and 6 per cent, but with the decimals changed to fractions. An article, on "Experiences and Suggestions Relating to the Preferred Number System," by R. E. Hellmund (*Mechanical Engineering*,

April, 1931) presented a table of fractional preferred numbers from 1 to 100. To avoid unpopular fractions such as $\frac{1}{64}$ and $\frac{1}{32}$ a certain amount of rounding off was found advisable. These fractional preferred numbers are shown in Tables V and VI. These numbers are also easily memorized from $6\frac{1}{4}$, 7, 8, 9, 10, and 11 of the 20 series. All other numbers in the range above 1 are obtained by halving or doubling these numbers. (Below 1, the 10 series may be constructed from $\frac{1}{16}$, $\frac{5}{64}$, $\frac{3}{32}$, by doubling repeatedly up to 1). Various other ways of memorizing these fractional preferred numbers could be suggested.

Fig. 1 is the reproduction of a micarta rule, $1\frac{7}{8}$x6 in., used by the Westinghouse Electric & Manufacturing Company. The decimal numbers are shown on the one side, while the fractional numbers are shown on the reverse side of the rule. In addition, different scales permit convenient measuring of the numbers in the series, as well as decimal inches.

The complete series of preferred numbers is readily read on the slide rule with a single setting, as suggested by R. B. Lincoln (Westinghouse Electric and Manufacturing Company). Reverse the slide so that the logarithmic scale appears between scale *A* and scale *D*, as shown in Fig. 2. The 5 series will be found by placing the runner over every $\frac{1}{5}$ division of the length (the even figures on the logarithmic scale), reading the result on scale *D*. For the 10 series, read every $\frac{1}{10}$ division (all

TABLE II				TABLE III				TABLE IV			
.001 to .01				.01 to .1				.1 to 1.0			
5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series
.0010	0010	0010		.010	.010	.010	.010	.10	10	.10	.10
							.0105				.105
		0011				.011	.011			.11	.11
							.012				.12
	0012	0012			.0125	.0125	.0125		.125	.125	.125
		.0014				.014	.014			.14	.14
							.015				.15
0016	.0016	.0016		.016	.016	.016	.016	.16	.16	.16	.16
							.017				.17
		.0018				.018	.018			.18	.18
							.019				.19
	.0020	.0020			.020	.020	.020		.20	.20	.20
		.0022				.022	.021			.22	.21
							.022				.22
							.024				.24
.0025	.0025	.0025		025	.025	.025	.025	.25	.25	.25	.25
							.026				.26
		.0028				.028	.028			.28	.28
							.030				.30
	.0030	.0030			.032	.032	.032		.32	.32	.32
							.034				.34
		.0035				.036	.036			.36	.36
							.038				.38
.0040	.0040	.0040		040	.040	.040	.040	.40	.40	.40	.40
							.042				.42
		.0045				.045	.045			.45	.45
							.048				.48
	.0050	.0050			050	.050	.050		.50	.50	.50
							.052				.52
		.0055				.056	.056			.56	.56
							.060				.60
0060	.0060	0060		064	.064	064	.064	64	64	.64	.64
							.068				.68
		.0070				.072	072			72	.72
							075				.75
	.0080	0080			.080	080	.080		80	80	.80
							.085				.85
		0090				090	.090			90	.90
							.095				.95
.0100	.0100	.0100		100	.100	.100	.100	1.00	1.00	1.00	1.00

TABLE V FRACTIONAL PREFERRED NUMBERS 1 TO 100

5 Series	10 Series	20 Series	40 Series	5 Series	10 Series	20 Series	40 Series
60%	25%	12%	6%	60%	25%	12%	6%
1	1	1	1	10	10	10	10
			1-1/16				10-1/2
		1-1/8	1-1/8			11	11
			1-3/16				11-3/4
	1-1/4	1-1/4	1-1/4		12-1/2	12-1/2	12-1/2
			1-5/16				13-1/4
		1-3/8	1-3/8			14	14
			1-15/32				15
1-9/16	1-9/16	1-9/16	1-9/16	16	16	16	16
			1-21/32				17
		1-3/4	1-3/4			18	18
			1-7/8				19
	2	2	2		20	20	20
			2-1/8				21
		2-1/4	2-1/4			22	22
			2-3/8				23-1/2
2-1/2	2-1/2	2-1/2	2-1/2	25	25	25	25
			2-5/8				26-1/2
		2-3/4	2-3/4			28	28
			2-15/16				30
	3-1/8	3-1/8	3 1/8		32	32	32
			3-5/16				34
		3-1/2	3-1/2			36	36
			3-3/4				38
4	4	4	4	40	40	40	40
			4-1/4				42
		4-1/2	4-1/2			44	44
			4-3/4				47
	5	5	5		50	50	50
			5-1/4				53
		5-1/2	5-1/2			56	56
			5-7/8				60
6-1/4	6-1/4	6-1/4	6-1/4	64	64	64	64
			6-5/8				68
		7	7			72	72
			7-1/2				75
	8	8	8		80	80	80
			8-1/2				84
		9	9			88	88
			9-1/2				94
10	10	10	10	100	100	100	100

TABLE VI FRACTIONAL PREFERRED NUMBERS 1/16 TO 1

* 5 Series	10 Series	20 Series	40 Series
60%	25%	12%	6%
1/16	1/16	1/16	
		9/128	
	5/64	5/64	
		11/128	
3/32	3/32	3/32	
		7/64	
	1/8	1/8	
		9/64	
5/32	5/32	5/32	
		11/64	
	3/16	3/16	3/16
			13/64
		7/32	7/32
			15/64
1/4	1/4	1/4	1/4
			17/64
		9/32	9/32
			19/64
	5/16	5/16	5/16
			21/64
		11/32	11/32
			23/64
3/8	3/8	3/8	3/8
			13/32
		7/16	7/16
			15/32
	1/2	1/2	1/2
			17/32
		9/16	9/16
			19/32
5/8	5/8	5/8	5/8
			21/32
		11/16	11/16
			23/32
	3/4	3/4	3/4
			13/16
		7/8	7/8
			15/16
1	1	1	1

* These are not exactly 5, 10, 20, and 40 series since the indicated number of steps are between 3/32 and 1 instead of between .1 and 1.

full figures) and for the 20 series every $\frac{1}{20}$ division. It should, however, be noted that the slide rule gives the exact figures, while the numbers to be used are rounded off figures, and differ slightly.

Preferred numbers should be used because they form the very basis of standardization. When new articles are to be manufactured, it is usually impossible to delay action until national standardization can be brought about. If, therefore, the individual manufacturers proceed with preferred numbers as the basis of their work, the chances are that the standards of the various manufacturers will already coincide to a great extent, if not completely, when later on national standardization is attempted. At times, the use of these numbers will result in national standardization without any further time-consuming and costly committee activities. Standardization of certain articles will also bring with it a standardization of tools and many other interrelated parts or articles. In cases where national standardization may never be involved, similar advantages will accrue from the use of preferred numbers, because it will tend toward standardization within an individual company. This is evident because the work of different departments, sections, or individuals will be coordinated automatically by the use of preferred numbers. Even with designs carried out by the same individuals adherence to the use of the preferred numbers will have the advantage of counteracting the use of too many or irregular steps in a line or unnecessary differences between successive designs. There is frequently an urge in practice for small and irregular steps or sizes because of some temporary advantage either from a design or commercial point of view. However, such temporary advantages are nearly always paid for rather dearly by the expense and complications caused by additional tools, stock, and spare parts, all of which will be avoided or minimized by the cultivation of a habit among designers to think always in terms of standardization by preferred numbers. That these preferred numbers represent a geometric series facilitates many calculations and eliminates a repetition of complicated calculations because many results will bear the proper relation to one another in a line of devices so based.

Preferred numbers may be used for:

1. Dimensions.
2. Cross-sectional areas such as that of pipes on which depend the amount of fluid passing through; the cross-section area of an electric conductor, which determines the current carrying capacity; the cross-section of a shaft on which depends the moment of inertia.
3. Cubic contents of certain devices, such as refrigerators.
4. Mechanical ratings, such as horsepower, cubic foot capacity of blowers or pumps, pressure ratings of blowers or pumps.
5. Electric ratings, such as kilowatts, kilovolt-amperes, amperes, and volts.
6. Power factor figures to serve as a basis for generator and transformer ratings.
7. Classification of sizes for various purposes such as ranges of shaft diameters with corresponding tolerances and coupling diameters.

In fact, preferred numbers have already been applied to:

(a) Dimensions:

1. Bores and outside diameters of motor armatures, and outside diameters of stator punchings.
2. Inside and outside diameters of punched circular washers.
3. Perimeter and height of transformer tanks.
4. Sizes of round, cold-rolled steel stock.
5. Sizes of broached holes, square or round, and corresponding drilled holes.
6. Key width and depth.
7. Commutator diameters.
8. Carbon brushes (width, thickness, and length).*
9. Mounting dimensions of electric motors, such as distance between holding-down bolts and height of center from base.

(b) Cross-sectional Areas and exponential factors:

1. The 10 series was used for the cube of the diameter of railway motor shafts. This means that the strength of shafts for a certain line of motors progresses in 25 per cent steps, and correspondingly the transmitting power of the shafts.
2. The B & S wire gage system approaches in the areas of wires the 10 series of preferred numbers closely. This system was developed long before preferred numbers were standardized.

(c) Contents of oil tanks and similar reservoirs.

*See table of German standards of Carbon Brushes in "Electrical Record," December, 1924; part of a paper on "Economies of Preferred Numbers to Electrical Manufacturers," by J. I. Hommel.

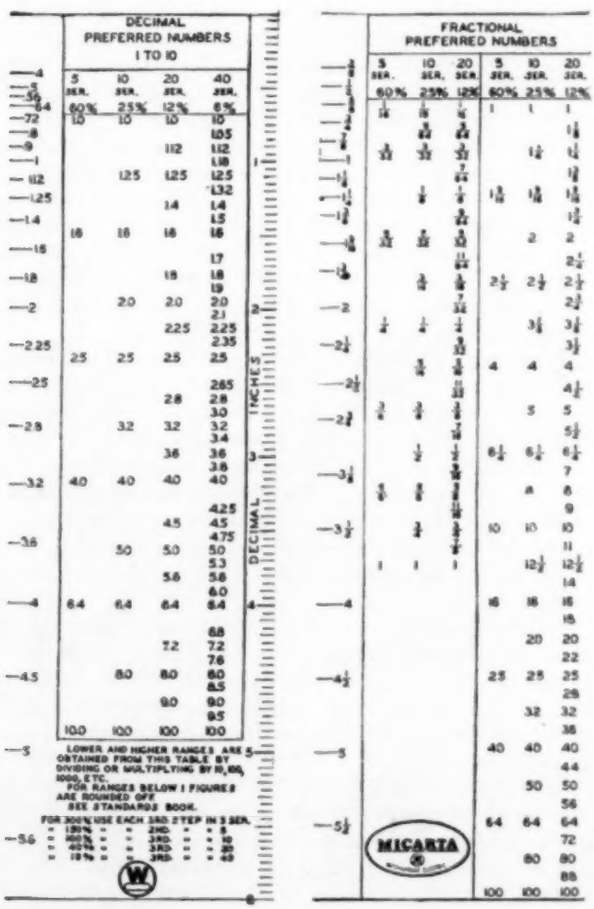

DECIMAL PREFERRED NUMBERS 1 TO 10
5 SER. 60%
10 SER. 25%
20 SER. 12%
40 SER. 6%
LOWER AND HIGHER RANGES ARE OBTAINED FROM THIS TABLE BY DIVIDING OR MULTIPLYING BY 10, 100, 1000, ETC.
FOR RANGES BELOW 1 FIGURES ARE ROUNDED OFF
SEE STANDARDS BOOK.
INCHES
DECIMAL

Fig. 1—A convenient 6-in. scale combines both decimal and fractional preferred numbers making it easy for the designer to apply them

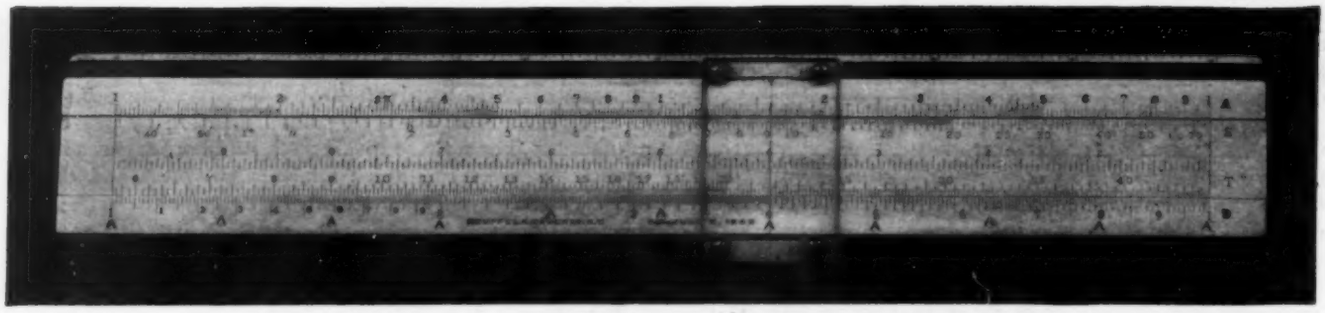


Fig. 2—In the absence of a special scale, a slide rule may be used to indicate preferred numbers. The series appears opposite equal divisions on the logarithmic slide

(d) Mechanical ratings:

Horsepower — seconds (kinetic energy) for flywheels are standardized on the 20 series of the decimal preferred numbers.

(e) Electric ratings:

Ampere ratings of grid glow tubes are based on the 5 series.

(f) The National Electrical Manufacturers' Association established 8 and 1, as standard power factors for alternator and transformer ratings; these are parts of the 10 series. On this account, it will be easy to have preferred numbers ratings in kw. and kva. (See *Mechanical Engineering,* April, 1931, page 288.)

(g) Classification of sizes:

1. Ranges of shaft diameters for which keys of fixed proportions are used.

2. Ranges of shaft diameters for which fixed machining allowances and tolerances are used, including bores of mating parts.

When using this system for dimensions, it is important to standardize on those dimensions which will bring about the greatest economy through their standardization. At times, preferred numbers should be used for dimensions and at other times for ratings, or it may be possible to use them for both. Economic factors should enter into the decision as to which of the two they should be applied in preference to the other.

Sometimes standardization of parts on a preferred number basis is more important than that of the complete unit. Preferably, and wherever possible, it should be applied to both. Again economic factors should be applied to make a choice where necessary. When applying the system to a device as a whole, overall, and mounting dimensions are frequently of greatest importance (refrigerators, ranges, motors, etc.). When attempting standardization of several dimensions or ratings, it must be realized that adding or subtracting preferred numbers does not result in preferred numbers. However, if a preferred number is multiplied by a preferred number, the product is a preferred number. Therefore, when it is desirable to have several interrelated figures in the preferred series, the ratio between them should be a preferred number.

Example: If shaft and key dimensions are standardized, the width of the key may be chosen to be 0.25 of the shaft diameter, and the thickness of the key 0.64 of the width of the key. Since both 0.25 and 0.64 are preferred numbers of the 10 series, all three dimensions—shaft diameters, width, and thickness of key—will be preferred numbers.

Even where there is only a single size or a single dimension to be considered, it should be one of the preferred numbers, partly because there may be a likelihood of a future extension, partly on account of possible relations to other parts, which may influence the application of preferred numbers, or because of tools available for other parts for which preferred numbers have been used. Preferred numbers should always be introduced when a new line of apparatus is developed. A study of possible applications should be made without delay, and plans for future standardization on the preferred numbers system laid out for existing lines of devices. When individual sizes or ratings are redesigned, they should be based on this system even though a redesign of the complete line is not contemplated. When standardization is already established, it is frequently not economical to change over to preferred numbers, but often restandardization is undertaken for other reasons. At such times the changeover to preferred numbers should be seriously considered.

The decimal system should be used wherever possible, because a closer approach to the established percentages can be realized and because it is adapted to any measusing system, whether the foot-inch system, the metrical or any other of the numerous measuring systems used in different countries. But the fractional system should be resorted to where the use of decimals would retard the adoption of preferred numbers altogether. Generally speaking, the fractional system may have to be used where national standards are on a fractional basis, such as with bolts and nuts; also for overall and mounting dimensions used by various trades not accustomed to the decimal system.

An attempt should first be made to use the 5 series, until sufficient evidence is produced that steps small enough to justify the 10 series are absolutely necessary. Similarly the 20 series should not be resorted to unless it is definitely established that steps smaller than in the 10 series are necessary. Frequently, past experience is a fair guide in the choice of the proper series. An analysis of existing sizes and a subsequent choice of the nearest preferred numbers for future work is frequently satisfactory.

There are often good reasons for using part of one series for a certain range and part of another series for another range of a line of devices. It often seems economical, for instance, to use a coarser series for the smaller sizes and a finer series for the larger sizes; again the medium range of a line may have a large activity and justify a fine series while either end of the line should be on a coarser series. Like other standards, preferred numbers must be employed with discretion. However, in the vast majority of instances, their use will involve little compromise in the desired specifications.

Worm Gear Generation

FRANCIS W. SHAW
Tool and Gear Consultant,
Heywood, England

A novel method of relieving tangential cutters effects surprising gains in production

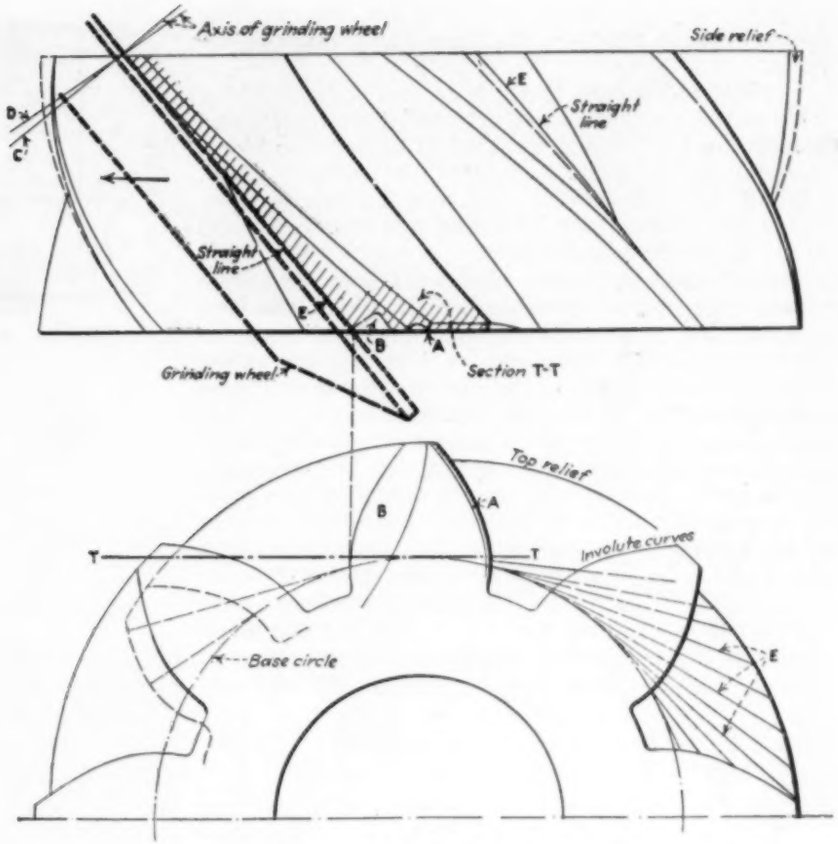


Fig. 1—This worm-shaped cutter for generating involute worm gears is ground with a combined side and top relief

IN VIEW of recent developments in the process of generating worm gears, an account of the experience of the writer may serve to prevent re-invention and expenditure on patents that could not be upheld. The means and methods herein described, which proved successful, are now made public for the first time for the benefit of those who may be hampered by certain patents now pending.

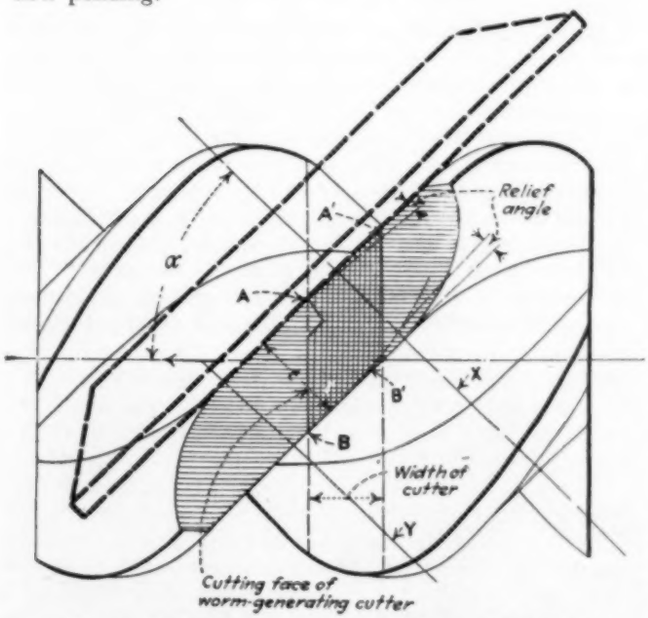


Fig. 2—If the angle α of the wheel be altered so the plane of the wheel lies at *A'* or *B'*, the only effect is to change the lead of the base helix, not the involute profile

When engaged as works manager for one of the larger gear production concerns, the writer conceived the idea, perhaps as many before him, of utilizing as a hob a short section of a worm, corresponding to the worm with which the gear was to engage, but made of suitable cutting steel. The idea was to traverse such a hob tangentially as is customary in generating worm gears.

Realizing, however, that if made exactly as a worm, though it might burrow its way through the blank, it could not cut efficiently, study was given the question of how to get effective yet simple relief. In the solution of this problem lies the novelty.

The worms, which the original cutters were intended to represent, were involute in their transverse sections as Fig. 1 discloses. In all worms of this type, and indeed in all helical gears that are involute in transverse section, will be discovered straight lines as *E* tangent to the helix at the base cylinder. Further, these lines lie upon the helicoidal tooth surfaces, extending upwards from the base cylinder to the crest cylinder, as is clearly shown in the lower view.

A little study made it evident that, provided an abrasive wheel of the type shown in the upper view were rolled in the direction indicated by the arrow, in conjunction with the worm, the rolling speed being that of the speed of rotation of the base cylinder or of the base circle of any tranverse lamina of the worm, and quite regardless of the angular setting of the wheel, some sort of an involute gear would be generated with a definite transverse sectional form. That is to say, at whatever

angle the abrasive wheel axis were set, the resulting profile in planes normal to the worm's axis, would be the same.

So, it would appear, herein lay a means for relieving without the complications that usually accompany this process, for the involute form would be developed automatically by the plane surface of the abrasive wheel. Later it was learned that this was the precise principle of the method used by at least two other companies in grinding their helical cutters.

But, the question arose, why not follow the system whereby the worms themselves had for a long time been ground—that of screwing the cutters endwise along the plane surface of an angularly set wheel. Since, as has been explained, the angle at which the wheel is set has no influence upon the sectional involute form, why not screw the cutters along the plane surface of a wheel set to a different angle than that required for the corresponding worms? That is, why not set the wheel axis as at *D* instead of as at *C*? At the same time, let the velocity of the endwise movement be increased so as to increase the lead of the base circle when one profile is being ground and decreased for the opposite profile so as to decrease the lead of the base circle. A little thought will show that the involutes so generated will be of the same base circle. Since one side of the thread is formed to one

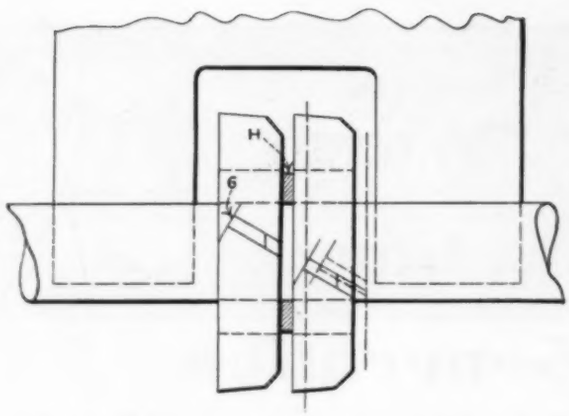


Fig. 3—Cutters, used in tandem, combine high productivity with adjustability. Rigid support is important for best results

helix angle and the opposite side to another, a thread is produced that tapers as it proceeds along the axis.

This result is shown clearly in Fig. 2 where a portion of the tooth has been sliced off down to the base cylinder. The abrasive wheel as set makes contact with the straight line *A*. A corresponding straight line *B* appears on the opposite side of the tooth. The worm thread may actually be ground by two wheels with their generating planes set apart the distance *t* their axes being *X* and *Y*.

In grinding the cutter, however, since the blank must screw endwise at different rates to get the desired relief, only one side is ground at a time. To affect this variation in the rate of twist, it is only necessary to alter the feed charge gears in the traversing motion of the worm grinder. The cross hatching shows how the change in the angular setting of the wheel introduces a clearance. The relief so produced can be described as side relief in contradistinction to the ordinary relief to which the term radial would aptly apply, for a similar effect could be produced in a relieving lathe by setting the relieving slide to operate sidewise instead of radially as is the usual practice.

In 1922, a British patent was granted to the writer for cutters of any sectional form so side-relieved. The patent covered worm-shaped cutters used either singly or in tandem in the manner Fig. 3 illustrates. The leading end of a cutter could, according to the patent, either be spooned out at the obtuse-angled cutting edge *B* and chamfered at the acute-angled edge, *A* as in Fig. 1, or ground normal to the thread as at *G*, Fig. 3. The leading cutter could also have its form arranged to lie within the finished thread helicoid so as to act as a rougher. Two thin cutters in tandem could be brought up to standard thickness by rotary or axial adjustment, axial adjustment being made by varying the thickness of a washer such as *H*, Fig. 3, it being assumed that both cutters would then be restrained from rotation by a key. In practice, it was found advisable to support the cutter or cutters by bushes held in a bracket as Fig. 3 diagrammatically illustrates.

Fig. 4 illustrates how the cutters used in tandem need have but one cutting edge accurately formed, the edge *M*. The edge *N* may be formed to any convenient shape, not necessarily straight as drawn. The top relief of any of the cutters can be far less than is usual in hobs. It is simply produced by grinding the blank taper inwards from the front to the back—a simpler operation than ordinary relieving.

The astonishing thing about these cutters is their

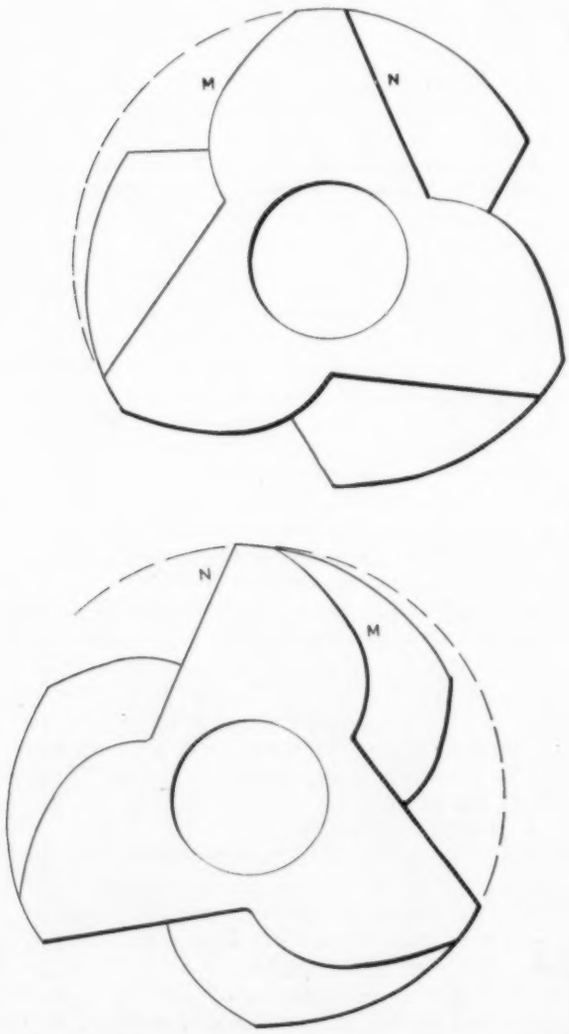


Fig. 4—The teeth of tandem cutters are ground back for clearance on one side, leaving one cutting edge

high productivity; they generate worm gears faster than other types of gear are produced. Here are a few examples:

Gears of 22 teeth, 1-in. circular pitch, 1⅛-in. face, of phosphor bronze were generated (cutting time only) in 5 minutes; for cast-iron gears, the time was 3 minutes; for 30-ton steel, 8 minutes. Phosphor bronze gears of 36 teeth to engage with 3-threaded worms 3¼-in. outside diameter, 45 deg. lead angle, were cut in less than 20 minutes. The finish and accuracy were excellent.

■

Gear Cutting in a Railway Shop

FRANK C. HUDSON

Gear cutting is not common in railway shops, but the Roanoke shops of the Norfolk & Western have quite a department which includes a good-sized hobbing machine as in Fig. 1 and a bevel gear planer as well as a plain gear cutter. The wall cabinet in Fig. 1 holds the tools

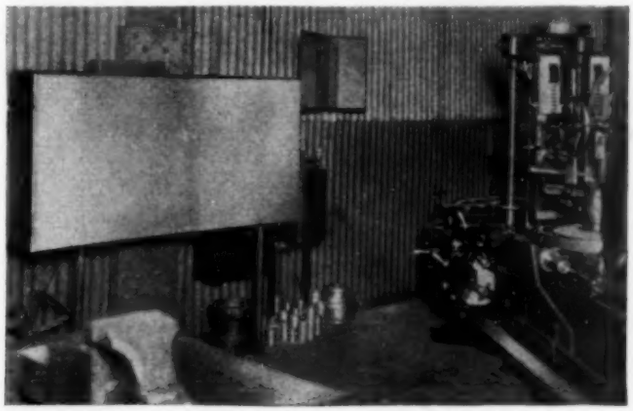


Fig. 1

for this department and is shown open in Fig. 2. Angles on the back wall form shelves for hobs and a few cutter arbors are held in the racks shown. On each side are two swinging plates or inner doors on which are hung the cutters and change gears used with these machines. The inside of the doors are also provided with hooks to hold cutters, wrenches and the like. Stops on the swinging doors keep them the proper distance apart when closed or when being swung open, and prevent damage to cutters. The weight of the cabinet and its contents is taken by the two tubular supports shown beneath these, having a flange that is bolted to the bottom plate.

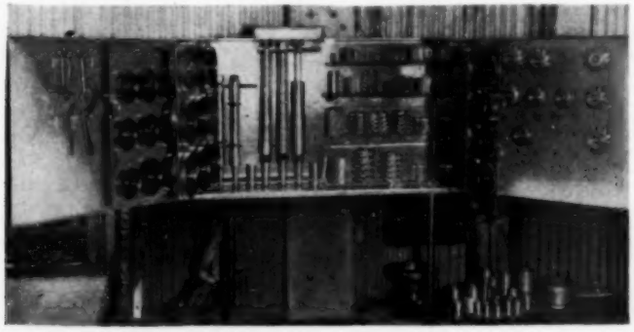


Fig. 2

NEW BOOKS . . . . . .

AMERICAN FOREIGN TRADE IN 1931—*Official Report of the Eighteenth National Foreign Trade Convention. 517 pages, 6x9 in. Clothboard covers. Indexed. Published by the National Foreign Trade Council India House, Hanover Sq., New York, N. Y. Price $2.50.*

Verbatim texts of mine general and group sessions and of ten dinner and luncheon sessions, together with 51 addresses on all phases of this year's foreign trade situation, are included in this report. The volume also incorporates a 12-page fact index of all outstanding items for ready reference use, as well as the names and addresses of 1,567 delegates from 35 states and territories of the U. S. and 24 foreign countries. The report emphasizes the need to "stop profitless merchandising" as the first requisite to recovery from the present situation, the subject of the single resolution passed by the Council. It was this resolution that made newspaper headlines throughout the country at the time of the convention and has since become an industrial battlecry. The proceedings of the meeting and the ready reference to the list of delegates make it handy for the manager.

THE RIGHT TO WORK—*By A. M. Lorentz. 154 pages 5¼ x 7½. in. Bound in cloth boards. Published by Richard G. Badger, Boston, Mass. Price $1.50.*

Another volume pointing out the reasons for the present depression and suggesting remedies for it. While admitting that the Socialists are possibly the only ones who realize the seriousness of the situation or who have a definite plan for relieving it, the author believes that certain improvements will make it possible to retain the advantages of the present system. It is a thoughtfully written book devoted to the different phases of involuntary idleness, from cause to cure. Students of economics will not agree with all the author's statements or conclusions; but those who wish to study the situation will be interested in this attempt to solve our difficulties.

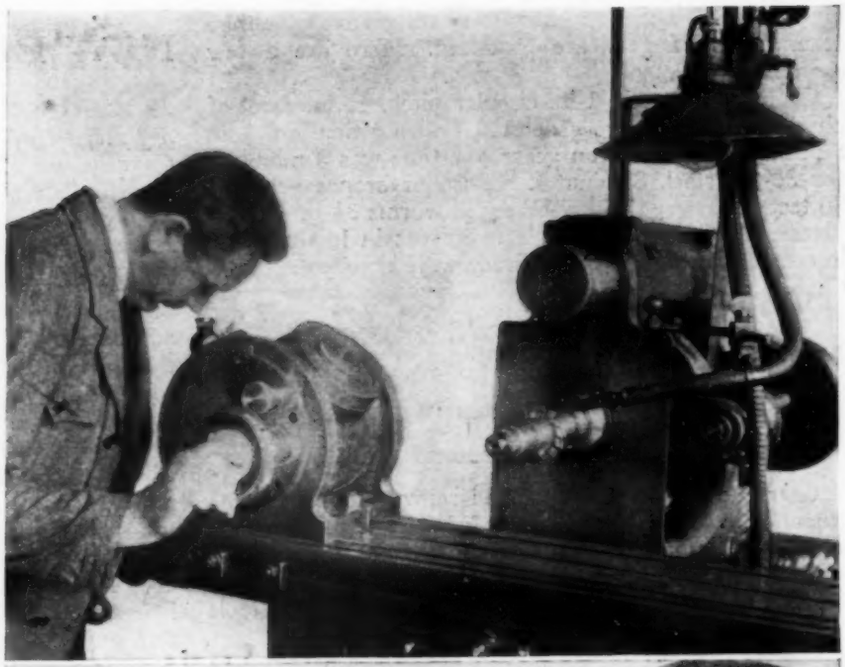
COMMERCE YEARBOOK—*Vol. 1, 1931. Prepared by the U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce, Ninth number. 696 pages, 9x6 in. Buckram covers. For sale by the Superintendent of Documents, Washington, D. C. Price $1.00.*

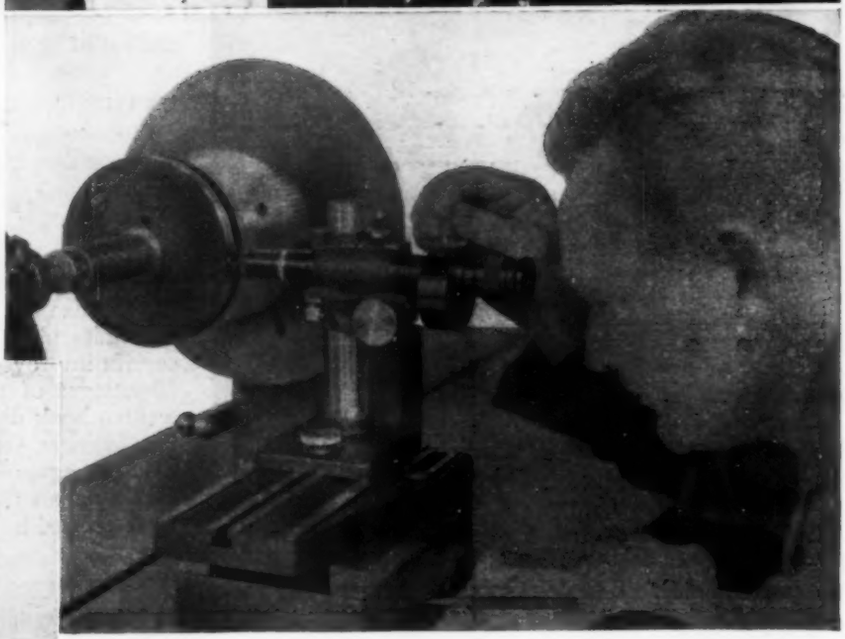
Detailed information on business conditions in the United States and its non-contiguous territories and possessions are contained in this volume. It incorporates statistical information originally collected by various government bureaus, trade associations and trade journals. Of the twenty-nine chapters in the volume, those of most importance to persons connected with the metalworking industry are as follows: Recent movements of production and domestic trade; General economic position and progress of the United States; Employment, unemployment, wages, and immigration; Wholesale, retail, and farm prices; Fuel and power; Construction; Iron and steel; Non-ferrous metals; Machinery; Automotive products. The data contained are for the year 1930 and are compared with previous years. In some cases information for early 1931 is available.

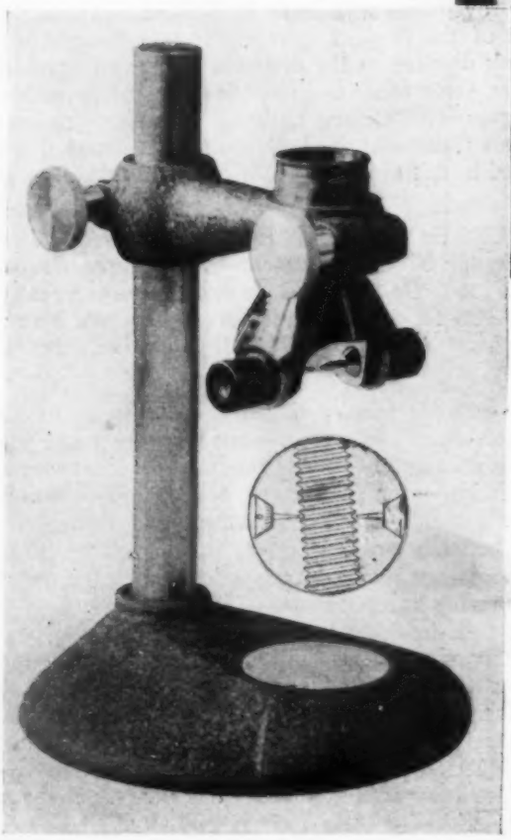
Precision Measuring Instruments

OLIVER P. VAN STEEWEN
Berlin, Wilmersdorf, Germany

The inspection methods and instruments used by our principal export competitor in machinery and machine tools are as arresting as the growth of the competition itself. This article is the last of a series







TOP

Fig. 23 — Dividing head in which the worm is used only for turning head

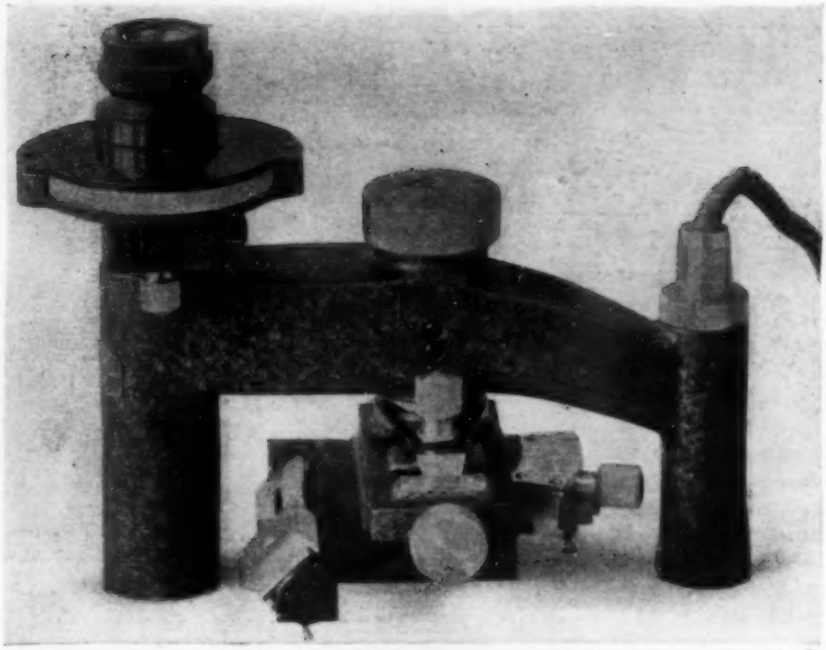
ABOVE

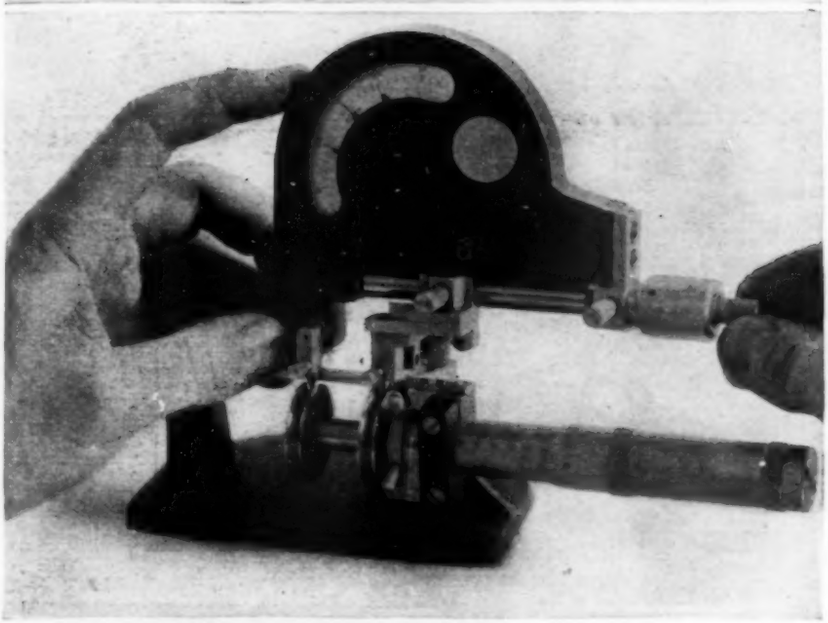
Fig. 24—Glass indexing plate with astronomical angular marking, for dividing heads, gears, cams, etc.

LEFT

Fig. 25 — Thread calipers with ball-shaped measuring points. Different size of point is used for each pitch

IN addition to accurately cut tooth outlines, the accurate spacing of index dials, cams, Geneva stops, etc., is required for satisfactory and silent operation. In many cases the accuracy obtained with ordinary mechanical dividing heads is insufficient, as the mechanical dividing means are subject to wear. This fault is remedied in the optical dividing head shown in Fig. 23. This device is similar in construction to the conventional dividing head. The spindle is driven by means of a worm and worm wheel; but in the case of the optical dividing head, the worm gear serves the sole purpose of driving the spindle. The adjustment is therefore entirely independent of the accuracy of the worm. As a means of dividing, a glass dividing plate is used. This is securely





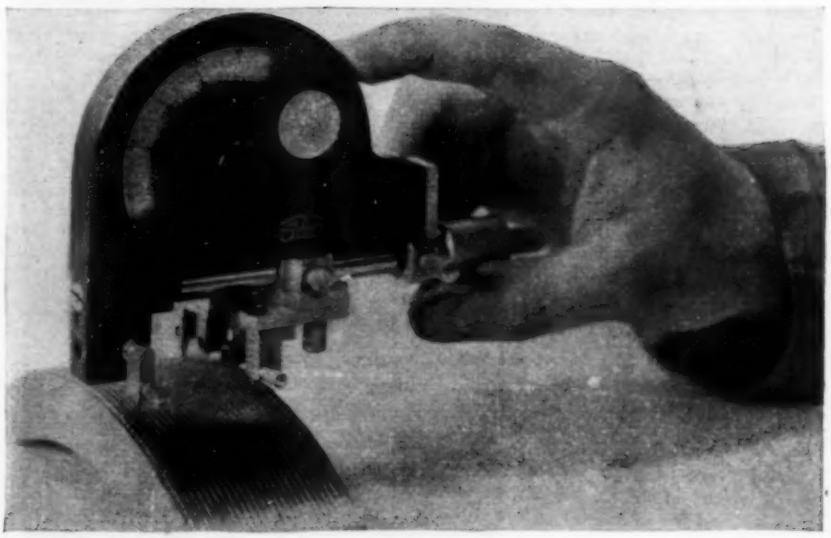


Fig. 26—Portable thread profile gage that can be used before the threaded part is finished

Fig. 27—Micrometer head used in conjunction with a thread center distance setting device

Fig. 28—This three-point attachment shows the cumulative error of threaded pipe

fastened to the dividing head spindle and is graduated with an angular precision possible only with astronomical instruments. A microscope is used to read the angular scale, which permits 15 sec. to be easily estimated without the use of a vernier.

In order to test the angular precision of ordinary mechanical dividing heads after their manufacture, or for wear, Zeiss supplies a dividing head controlling device. With this instrument every dividing operation is checked. Deviation of the dividing spaces can be read in the microscope with an accuracy of 6 seconds. Fig. 24 shows the testing of a dividing head for a dividing factor of, say, 120. The index dial is arranged for dividing into 120 parts. For each operation the dividing head spindle, and thus also the testing dial of the instrument, is turned 3 deg. Every third division of the testing dial must check back with the zero mark if the dividing head under test is correct.

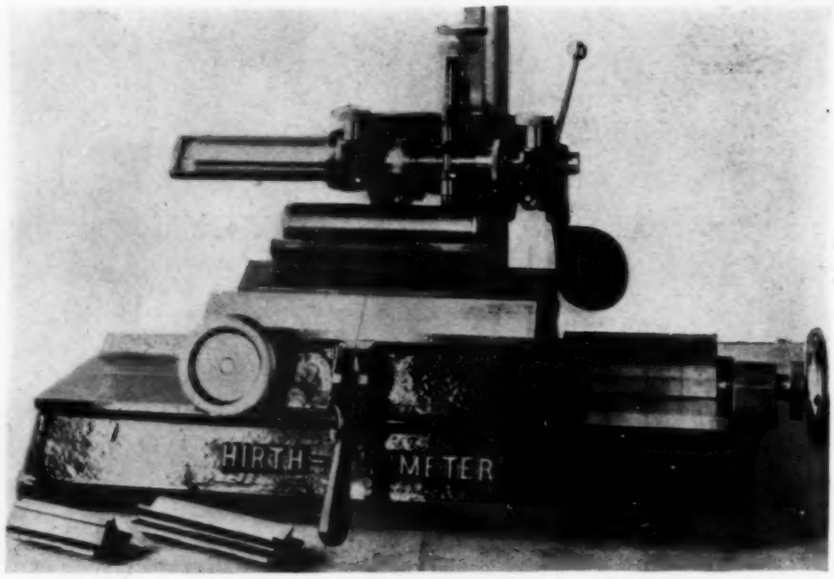
In June, 1930, the German Industrial Standardization Committee brought to a conclusion its work concerning the standardization of threads; hence the testing of threads has received much attention. A number of measuring instruments were designed which can be regarded as standard. From the simple screw pitch limit gages with measuring disks for testing right- and left-handed threads, development led to optical instruments.

Optical thread calipers for determining pitch diameters are shown in Fig. 25. The spherical points, to be seen in the insert, are adjusted by means of micrometers. When contacting with the screw the spherical points must touch the flank faces of the thread in such a manner that the screw will slip down between them by its own weight. The deviations of pitch diameter of the tested pieces from the screw gage or standard piece can be read from a scale in the visual field of the lens with an accuracy of 0.00025 in.

Fig. 26 shows a screw profile microscope, intended for determining

the thread depth, the roundings of the face angle, and the correct position of the profile at a right angle to the screw axis. The instrument is characterized by a three-point support on the flank faces. To take measurements, its three spherical contacting points are placed on the thread to be tested. In zero position, the connecting lines between the spherical points form a right triangle, one leg of which must always remain in parallel to the axis of the object under test. The other leg is so moved that the resulting divergence is approximately equal to the pitch of the thread. The construction of the instrument is such that all three spherical points of support can be set in correct relation to each other, the third point, outside of the measuring axis, being movable on the periphery of a circle the center ponit of which lies in the axis of one of the other two points of support. The bracket supporting the microscope and the illuminating device is adjustably connected to the bridge in such a manner that the light-rays of the lamp, after being deflected in a horizontal direction by a mirror mounted at an angle of 45 deg., strike the thread and thus produce an image of its contours. The rays then enter the objective of the microscope and are here deflected in a vertical direction by a 45-deg. prism in order to be observed through the eye-piece. Below the eye-piece an etched, revolving disk is provided, with the standard profiles of various kinds of threads marked on it. The testing of the thread is accomplished by turning the revolving disk, and at the same time moving the instrument in the direction of the screw axis, until the image of the thread contour and the standard profile on the disk are in line, the latter acting as a templet for comparison. The spherical points used as gages are interchangeable for each type of thread tested.

In Figs. 27 and 28 a Zeiss pitch checking instrument is shown. In its appearance it resembles the Passameter. In place of the anvils, however, supports for the interchangeable spherical contacting points are provided, one of which remains fixed during measurement, the other being variable over a small range. By means of a lever, movement of the movable contact is transferred to the indicator mechanism, and positive or negative deviations from standard are indicated on a scale provided with adjustable limit marks. As little as 0.0004 in. can be read direct; smaller



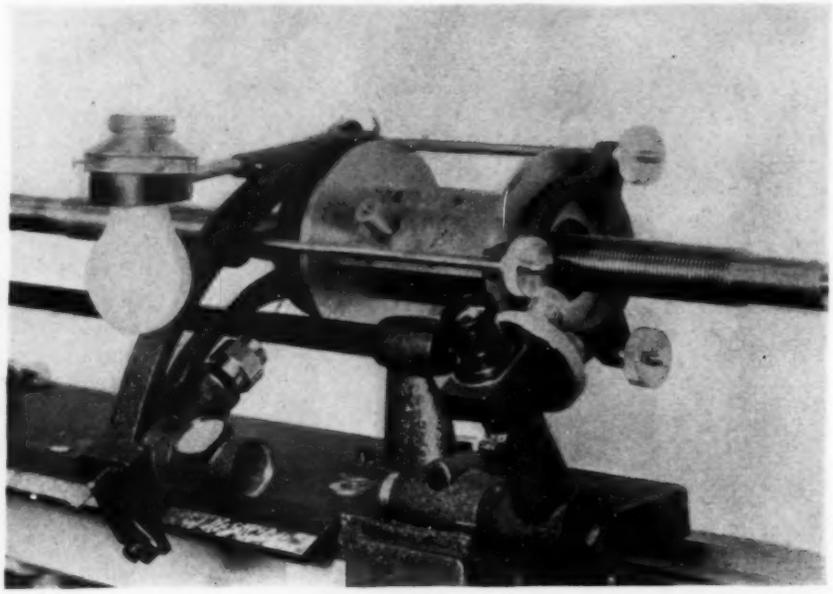


Fig. 29—Another cumulative error gage. Here Swedish gage blocks are used for comparison. The part is held in position by a wire under tension

Fig. 30—A periscope optical arrangement, one end of which moves with the work, allows of making direct comparison between the pitch of the lead screw and a scale on the round rod

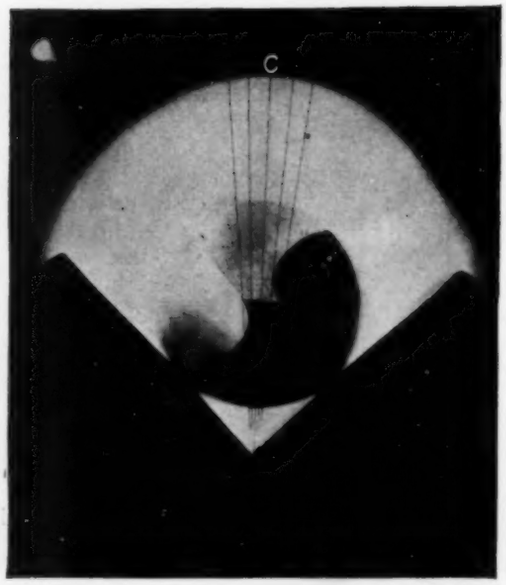


Fig. 31—Visual field of a twist drill gage

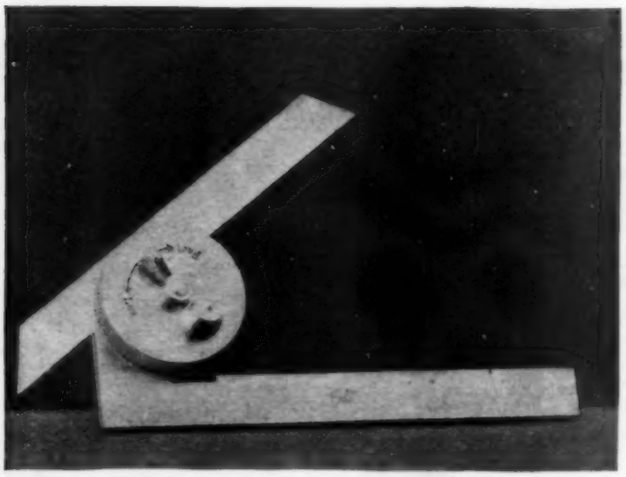


Fig. 32—Optical bevel protractor. The angles are read by a lens

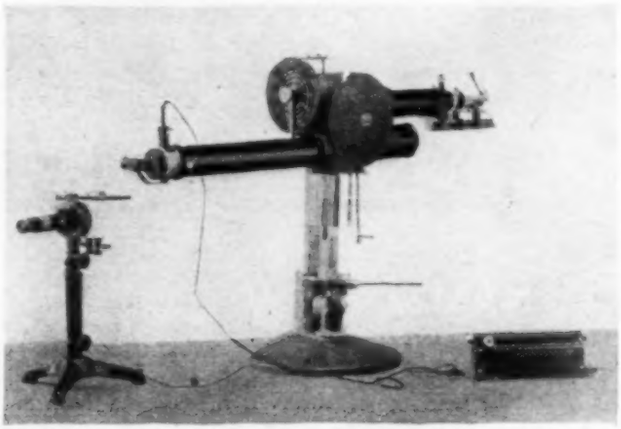


Fig. 33—Interferometer for comparing gage blocks

intervals are easily estimated. A more elaborate device for measuring thread pitches is made by Fortuna Werke. With this measuring machine, Fig. 29, the pitch of a thread is checked by precision gage-blocks. The thread to be checked is put on the slide of the machine and fixed with a clamping wire. For smaller threads a corresponding V-block is placed on the slide, this latter then being pushed to the right till it touches the adjusting screw. The column carrying the measuring instrument is then set so that the measuring pin is approximately in a vertical position above a thread groove near the left end of the gage. Lowering the measuring device, the measuring pin enters the thread groove. Next, the slide is adjusted in a longitudinal direction by means of the adjusting screw at the right, until the pointer of the Minimeter covers the center line of the scale. The adjusting screw is then locked in this position by tightening the knurled nut. After lifting the measuring instrument, the slide is shifted to the left, a precision gage block of the supposed measure of one, or preferably several, thread pitches is put between slide and adjusting screw, and then the slide is again moved to the right up to the fixed adjusting screw. The measuring instrument, now lowered again, accurately indicates the deviation of the thread pitch from the supposed measure.

A device designed for checking the pitch of lead screws is shown in Fig. 30. It differs from other similar testing devices in that each lead screw is tested together with the nut belonging to it, thus guaranteeing a correct test for their combined working later on. Measurements are made by comparison with a steel scale fixed parallel to the measuring axis. An item worthy of notice is the optical system. According to a principle stated by Professor Abbé, both the measuring axis and the axis of the scale must lie in a straight line for most accurate measurements. If this direct-comparison principle were to be carried through when measuring long spindles, exceedingly long structures would be required. By means of the novel optical system this disadvantage has been avoided in this device, and the scale may be located outside the measuring axis as shown.

One of the problems in duplicate manufacture is the diameter of drilled holes, something that is dependent on the satisfactory condition of the drills. For the purpose of checking drills a twist drill lens, Fig. 31, is made by Zeiss. When checking the symmetrical grinding of the point, the drill must be so placed inside the tubular housing of the lens (provided with a prismatic extension), that line *C* shows approximately at right angles to the cross edge of the point. For better understanding, it should be further mentioned that inside the housing there is a lens as well as an angularly marked glass plate. Line *C* divides the angle of the prism into two equal halves. In case the distance from the lines still remains the same after the drill is turned 180 deg., the point is correctly ground.

Considerably increased accuracy in the measurement of angles is enabled by the optical bevel protractor Fig. 32. Readings are taken by means of a lens; the accuracy is 10 min. Two minutes can be easily estimated.

The most accurate testing method for practical use is, no doubt, that based on the light interference principle. However, a detailed discussion of this intricate optical phenomenon would not fit into the scope of the present article. Suffice it to state that in practice the interference method is used in many shops for comparison measurements of precision gage blocks. The interference comparator of Köster's, is represented in Fig. 33. The accuracy of this method of measurement is approximately 0.000008 in. However, this accuracy is only obtainable by strict observance of laboratory conditions, constant temperature, absolutely first-class polished surfaces, etc. In practice, such accuracy is not required and is not asked for, as precision gage blocks thus made would be exceedingly costly. It is considered sufficient to determine the length of a 10 centimeter, (approx. 4 in.) steel rule within 0.3 mu. or 0.000012 in.

The aim of the present article is to give a clear conception of the precision mechanical and optical measuring being used in Germany, and of the accuracy striven for in the manufacture of machine tools. The effects of standardization and the development of gages to maintain those standards are both already apparent, and Germany has again become an important factor in the world market.

The last of a series of three articles.

Guesswork in the fabrication of welded boiler drums, oil stills and other pressure vessels is eliminated by using the X-ray for formulating production technique and in final inspection

W. H. SHIPMAN
Special Products Engineer,
The Babcock & Wilcox Co.

Guaranteed by X-Ray Inspection

RELIABILITY of welded boiler drums, oil stills and other pressure vessels must be guaranteed to the customer. At the Barberton plant of the Babcock & Wilcox Co., one hundred per cent X-ray inspection of all longitudinal and girth seams in such products is resorted to in order that such a guarantee may be offered. This inspection is not prohibitive in cost as compared to the cost of the product, and also has many advantages as an aid in developing welding technique on a line of work where the value of material and labor lost in scrap could be high. For either use, the X-ray causes no damage to the parts inspected.

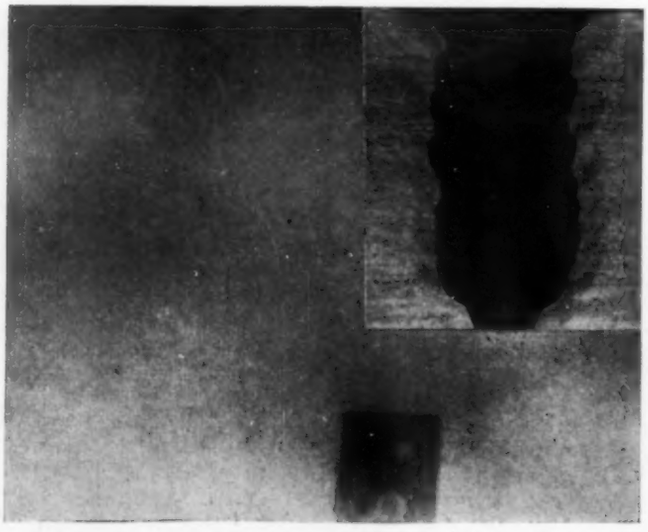


Fig. 1—Excellent weld in boiler plate

The original use of the X-ray along these lines was that of assisting in the development of a weld equal to, or better than, the parent metal in tensile strength, shock resistance, ductility and ability to withstand repeated stresses. For a given section to be joined there is a correct type and size of electrode, current and potential, and electrode coating, the combination of which will give the best weld. X-ray inspection has been the only method by which these factors could be studied readily and with definite results.

In studying X-ray negatives, it must be remembered that the relative density of the various parts of the object are recorded on the film. The darker spots on the film indicate that the density in that part of the object is lower than elsewhere and has thus permitted more X-rays to pass through. When the negative is printed, the dark spots are shown up as light spots. Hence on an X-ray print, cavities or gas inclusions will show up as light spots, and heavy impurities or more dense metal as dark spots. Defects down to 1 per cent of the total thickness of the material are observable in steel ranging from 1 to 3½ in. in thickness.

Defects in electric arc-welds as revealed by X-ray examination are:

1. Poor penetration or improper fusion at the scarfs between the weld and parent metal.
2. Laps that are not fused.
3. Gas pockets.
4. Shrinkage cracks.

The first two conditions usually result from slag in-

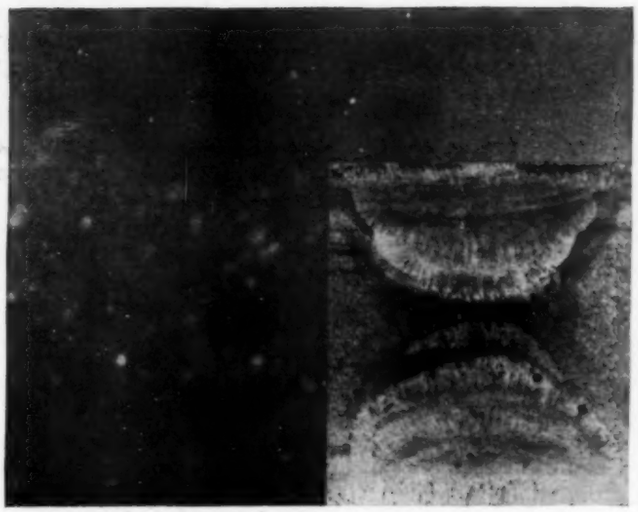


Fig. 2—Porous but acceptable

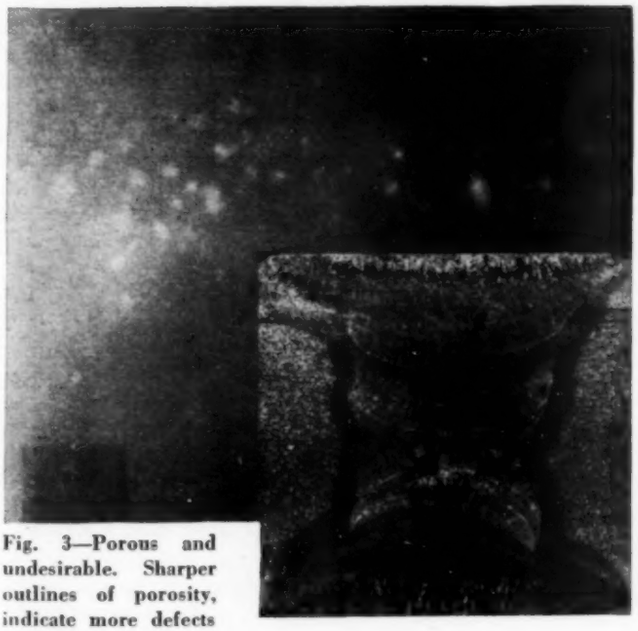


Fig. 3—Porous and undesirable. Sharper outlines of porosity, indicate more defects than in Fig. 2

clusions or from a thin film of oxide. Shrinkage cracks seldom occur.

From the accompanying illustrations, it will be seen how various electric welds show up in X-ray pictures. Fig. 1 illustrates an ideal weld such as produced under the very best controlled procedure. This weld shows up clear with an even density throughout. Fig. 2 shows a porous weld but one that is acceptable. The difference between this weld and that shown in Fig. 3 will be readily seen, the latter showing well-defined, larger and more numerous defects. Fig. 4 shows the result of improper cleaning of the layers of the weld beads, with the inclusion extending along the wall of the joint and the mottled condition arising from porosity. This picture clearly indicates that each bead must be thoroughly cleaned before another is applied. All foreign material such as flux or any oxide accumulation from the preceding weld must be removed. Improper fusion may be obtained along the walls of the weld, leaving a small air space where the welding rod material has bridged over rather than fused. Fig. 5 shows a weld which is full of gas cavities. A varying density of metal will be noted as some of the sections appear darker than others. From outward appearances it looked as good as that shown in Fig. 2. In any case, the X-ray is helpful in setting up a manufacturing technique which will avoid or eliminate faults, and which will give an idea of acceptable welds when the pictures are correlated with the physical properties.

At the Barberton plant, the Coolidge tube is used with the X-ray apparatus, and the size of the film is varied according to the type of material inspected. For longitudinal welds the 4½x15-in. size is readily taken. For circumferential or girth seams the 4½x9¼-in. size is the most desirable. In each case, the 4½-in. dimension is the width. Time of exposure varies from a few seconds for this plate to 70 min. for penetration of 3½-in. steel plate. The cost of continuous use will not be more than $5.00 an hour ordinarily.

In any plant the introduction of radiography, whatever its use may be, should be supplemented by intelligent and conscientious support of the shop personnel. If this course is taken the X-ray method of testing and development will be a new incentive, keeping the men constantly on the alert to develop work which will show no defects.

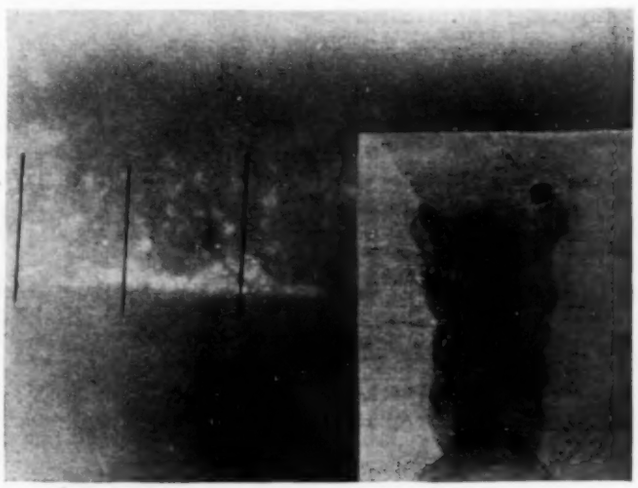


Fig. 4—Porous weld metal and slag inclusions along wall of joint, not acceptable

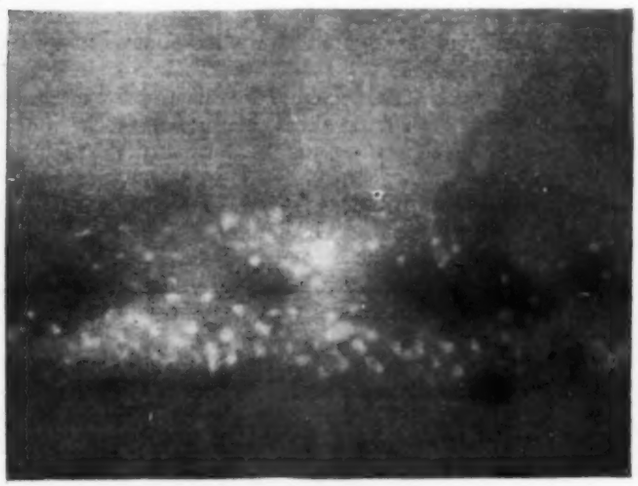


Fig. 5—An extremely porous weld, indicating gas cavities

The Handicap of Age

TOM WHITE

THOMAS A. EDISON once said, "No man has any sense till he's past forty." This remark was made to an employee while the "Sage" was driving an argument home. Nevertheless, it seems to me that he was right. The experience of over forty years in machine shops gives me many unanswerable arguments to back up Mr. Edisons' statement.

Today, with our almost universal Employers Liability Acts, and the consequent injection of liability insurance into the scheme of things, a man who is past forty is damn lucky to be holding his breath, let alone a job.

Every large manufacturing establishment now has an employment office, which is presided over by a young man (under forty) who is efficient and competent to an almost omnipotent degree. He is familiar with intelligence tests, and knows how to ascertain the I.Q. of an applicant. But if you are unfortunate enough to be prematurely grey at the almost adolescent age of fifty or thereabouts he won't even take you by the hand to feel whether your palm is wet or dry.

This is all wrong. I make this statement boldly and unequivocally. Any manufacturing plant, large or small, that does not recognize and put a premium on the services of men who are over fifty, and, therefore, according to the insurance companies, super-annuated, is defying an economic law that is older than the laws of the Medes and Persians. I feel rather strongly on this subject, partly because I am some years over fifty, and partly because I hate waste. And it is just as wasteful to waste available brains as it is to scrap any other product.

Some years ago, about twenty-five to be exact, I was foreman of a shop in which electrical instruments were produced. The town in which the plant was located was a one-shop town. That is, it was the home of a huge establishment employing several thousand men, engaged in the manufacture of steel. The plant also produced immense engines, and could equip anyone with a first class navy if desired.

The only mechanics available in this town were men who for some reason or other could not work in the steel works. As these men had all been trained to think that a chip was not a chip unless it was blue, and a tool would invariably slip unless it was clamped down with a tool post wrench at least 18 in. long, I had a regular time trying to train them to drill holes with a No. 55 drill, or to tap holes with a 2-56 tap. Our tap and drill breakage was terrific. Finally in desperation I hired an old man.

He was over sixty, had been an insurance agent for most of his life and knew nothing about a machine shop, except that he would most likely be freer from rheumatism than he had been in his former occupation. After he had been broken in to perform two or three operations, I hired another old man, a carpenter, then a superannuated grocery clerk. In less than one month the breakage had been reduced 60 per cent and production increased 50 per cent on the jobs they were doing. They were eager to learn, interested in the work and nothing else, and were content to stay on a job that each one considered the best he had ever had. Within a year I had replaced nearly all the steel-works-trained mechanics with farmers, teamsters or barbers. The results more than justified the experiment.

However, this is the young man's age; nothing I can say or do will change that. Some twenty years ago when I was thirty-five or so, I thought that after I had had a few more years of experience I might amount to something as a mechanic. Now that I have accumulated what I consider the necessary experience, I am too old to work. At least that is what the employment managers tell me.

Last week I dropped into George Blitz's machine shop. George runs the only jobbing shop in our town, and since prohibition, it is about the only place in town where a group of mechanics can foregather and exchange ideas. Adam Calhoun was there when I dropped in. Adam has invented a "new and useful device" that he claims will prevent operators of power presses from losing their arms and legs. He rents shop room from George, hence he is likely to be there at odd hours. Both George and Adam are old men. George is so feeble that after he has worked twenty or thirty hours on a breakdown job, and has driven his car eighty or ninety miles to deliver the job, he is practically all in when he gets back to the shop, and can hardly wait till the whistle blows to release him so that he can drop into his favorite speakeasy and play pinochle half the night.

George and Adam and I were having a fine time damning the administration and explaining to each other how rotten the times are, when a young man dropped in. I don't know this boy's name but he is "good." I mean he was good for us. He is a planer hand in a local shop and he leaves no one long in ignorance of the fact that he is chief engineer of the only 6-ft. planer in town. He opened, or rather, horned into the conversation by asking me what I thought of a man who would design a 6-ft. planer that would only feed down 7½ in. I told him plainly that a man who would do a thing like that ought to be shot. The young fellow seemed to appreciate this solicitude and said he thought so to. He was an earnest sort of a boy. He then proceeded to expound and develop several theories he had originated, on the management of machine shops in general, with an eye to the design of machine tools in particular. We learned a lot from that youthful savant. And we were not too proud to let him know that we appreciated all the free information he was giving us. This encouraged him. After awhile he said in an offhand manner that all the important inventions were being developed nowadays. That none of the old time inventors amounted to much. We said, "Is that so?" I was mentally preparing a mass of statistics, starting with Jamie Watts, and Geo. Stephenson, and winding up with Tom Edison. In fact I was even preparing to invent a few inventors. George was on the verge of a violent explosion. Adam however saved the situation and took several years' wear and tear off our arteries. Adam is of Scotch parentage and is not extravagant. He reached over to the bench and picked up a cap screw. "There," said he, "is an old-time invention. Let's see you beat it." The young fellow came up for air three times, but finally he sank and passed out of our lives forever.

Ideas from PRACTICAL MEN

Evolution of a Spindle Support for Deep-Hole Grinding

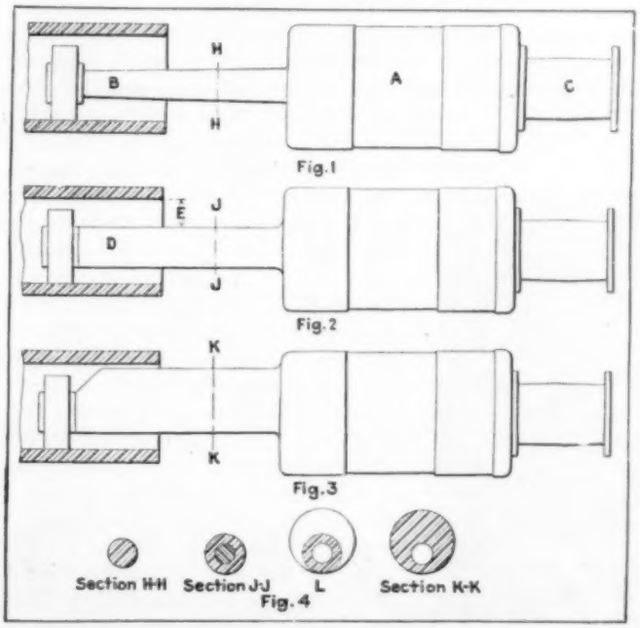
F. A. FIRNHABER
Machine Designer, Landis Machine Company

The greatest difficulty in grinding deep holes is on account of the lack of stiffness of the grinder spindle. The ordinary spindle, shown in Fig. 1, overhangs the ball bearings in the housing *A* too much, causing the grinding wheel to spring away from the work when a large infeed is used. The projecting portion of the spindle *B* is usually integral with that part supported by the ball bearings, and is driven by the pulley *C*. The diameter of this spindle is limited by the bore of the ball bearing, because of assembling purposes, and in many cases is too small for the required rigidity, thus producing a bell-mouthed hole in the work.

In the grinder shown in Fig. 2, the projecting part of the spindle is supported by a steel sleeve in which there is an additional ball bearing at *D*. The outer diameter of the sleeve for its full length is the same as that of the collars confining the wheel, giving an added stiffness of at least 25 per cent to the spindle. The design of the sleeve in Fig. 3 is a modification of the one in Fig. 2. Here the sleeve is eccentric with the housing. Assuming that the grinding is done on the side of the hole next to the operator, the space *E*, Fig. 2, can be utilized for the eccentricity of the sleeve.

A comparison of the cross sections of the spindle in Fig. 1 and the spindles and sleeves in Figs. 2 and 3 can be seen in Fig. 4. In this particular size of spindle, the sleeve shown in section *J-J* renders it 25 per cent stiffer than the unsupported spindle in section *H-H*, and the sleeve in section *K-K* renders the spindle three and one-half times stiffer than does the sleeve in the section *J-J*, and four times as stiff as the unsupported spindle.

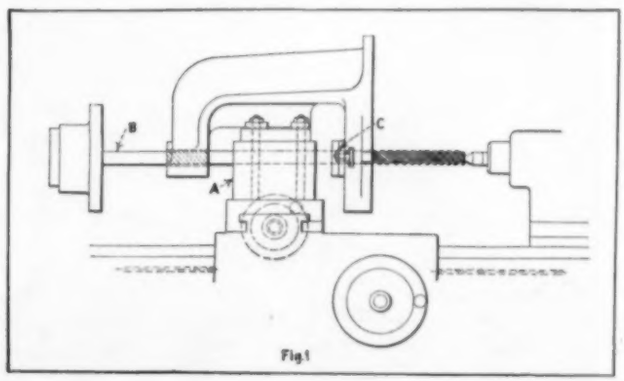
A spindle supported by a sleeve of the section *K-K* permits heavier cuts to be taken, reducing the floor to floor time, and at the same time assuring that the hole in the work will be as true and straight for its entire length as it is possible to grind it. Since the sleeve shown in Fig. 2 must be made of steel to obtain strength, it is more costly than the one in Fig. 3, which is of cast iron. At *L*, the black portion shows the comparative amount of metal added to that in the sleeve in section *J-J*. In actual tests, the spindle supported by the eccentric sleeve proved itself to be by far the most superior.



Cutting Three-Start Internal Threads

JAMES R. CORNELIUS
Machine and Tool Designer
Coventry, England

We received an order for a large lot of percussion presses in which the screws were to fit holes tapped directly into the arms. The screws were 2½ in. in diameter and had three-start threads. Not having a boring machine or a drill press heavy enough to chase the internal threads, which would naturally need assistance such as from a lead screw, we rigged up a heavy lathe in the way indicated in Fig. 1. The bases and the



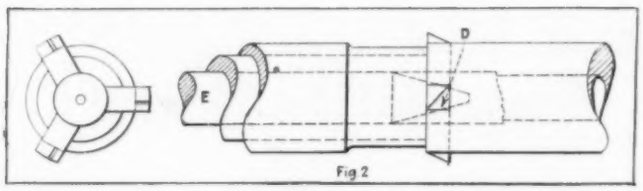


Fig 2

tables of the presses were planed, as were also the slide faces. The lathe carriage was prepared by removing the compound rest and substituting therefor two parallel blocks *A* pinned on the toolblock.

The chasing bar *B* was made, one end being threaded to the same lead and pitch as the internal thread to be cut, the threaded part being of such length as to permit the nut *C* to travel along the bar for at least twice the height of the press head. The nut *C* was made in two parts that could be closed together to eliminate all play between it and the screw. The end of the bar next to the driving plate was reduced in diameter, a sleeve being fitted over this portion, as shown in Fig. 2. Three square holes were machined in the bar to receive the cutters *D*. The bar was also bored to receive the actuating rod *E*, which had a conical point impinging on the inner ends of the cutters. This rod was screwed into the bar and was long enough to extend clear through the spindle, so that the operator could turn it at will and so expand the cutters. When expanding the cutters, the sleeve was loosened slightly, being tightened to lock the cutters after expanding them.

In operation, the carriage was not moved directly by the nut on the threaded end of the bar, but the lead screw was geared and engaged to divide the thrust. By this method, all the presses were threaded without difficulty. As a matter of interest, the actual time for each press was 1½ hr., floor to floor, the work being done by an apprentice who was in his third year.

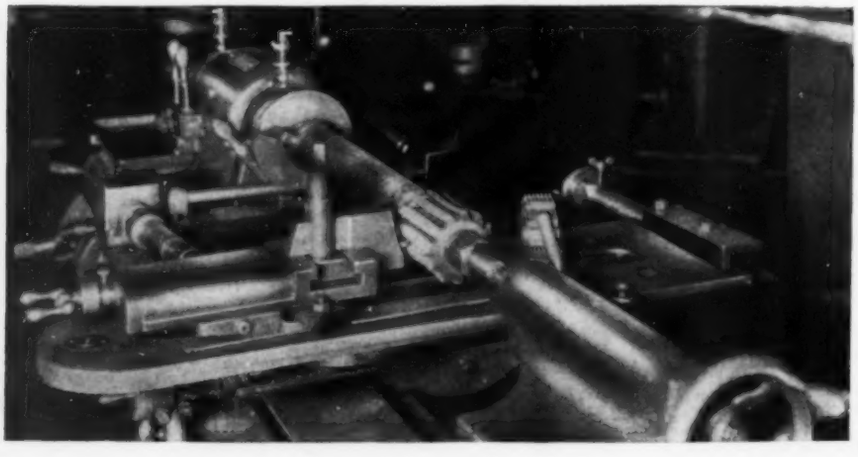
Backing-Off a Concave Cutter

CHESTER H. FRANKLIN

An interesting toolroom job found in the Roanoke shops of the Norfolk & Western Railway, and one that can be adapted to other uses, is the backing-off of the cutter for throttle quadrant teeth. The device, the lower plate of which is bolted to the carriage of a toolroom lathe in place of the compound rest, gives any desired radius according to its position on the carriage. This radius is the distance from the fulcrum to the tool point. The back end of the upper plate is cut like the segment of a worm gear while the lower plate carries a worm operated by the handwheel at the rear. This wheel has a ring graduated in minutes and subdivided into five seconds. The ring can be reset at zero at any time so that on moving the tool from one tooth to the other the ring is moved to the same graduation each time, making mistakes less likely to occur. The plates can also be locked together after each setting. By reversing the lower plate so that the fulcrum is at the rear a convex cutter for the latch can be backed-off with the same device.

The relieving attachment is fastened to a flat plate across the shears of the lathe near the head. The mechanism is driven from the back of the lathe through bevel gears with the usual universal joints between the tool slide and the gear box.

The whole device is substantially built and is adjustable to meet nearly all conditions. The design of the toolholder to bring the cutting edge at the center line and hold the tool rigidly is of special interest.



Cutting Multiple Threads—*Discussion*

D. Q. DUNSTONE
Durham, England

I have been a reader of contributions to *American Machinist* on the cutting of multiple threads since Harvey Chandler (*AM*—Vol. 73, page 172) made his contribution, and frankly, I am disappointed in the course it is taking. One writer after another seeks to decrease the possible error just a little.

It is my opinion that a measuring rule should not be used at all to divide the pitch for a multiple thread. William S. Rowell admits that the compound screw is unreliable for measuring purposes, and I must add that the circular reading for the compound rest of the average lathe is far from accurate. Such a reading as 59 deg. 40 min. would be quite impossible.

Providing the lathe center is true, Charles Kugler's contribution (*AM*—Vol. 74, page 658) offers an ideal solution to the cutting of multiple threads. If the angular division is not reliable, or the cost of manufacture of the driving plate unjustified, I suggest the following way out.

The periphery of a common driving plate is divided into a number of divisions equal to the multiple of the thread to be cut.

A pointer to register with these divisions should be fixed directly to the work. The driver should carry the work so that the pointer registers with one of the divisions made on the driving plate. After the cutting of one thread the driver should be loosened and the work turned in the center so that the pointer registers with the next division on the plate.

The driver is tightened and the second thread is cut. This process is repeated for each thread until the screw is completed. The machine setting need not be altered as the indexing is done by the driving plate.

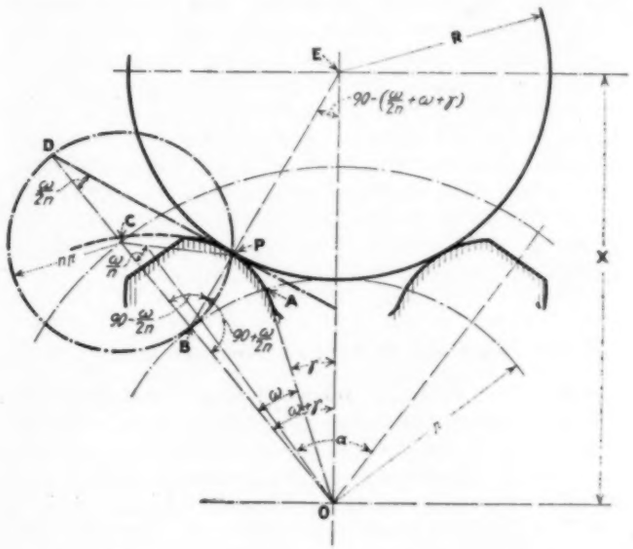
By this method, calculation by the turner is avoided, and the accuracy of the division is improved as the diameter of the driving plate increases relative to the diameter of the work.

Pin Inspection of Cycloidal Spur Gears

HANS SCHEMM

A common practice in checking spur gears is to place pins between the teeth and to measure the distance over the pins with a micrometer. Another shop practice in reboring and finish boring spur-gear hubs is to locate the gear by pins between the teeth having a sliding fit in a ring mounted on the faceplate of a lathe and running absolutely true. Thus the bore of the hub will be concentric with the curves of the teeth.

The following formulas were developed to calculate the dimension over the pin for a tooth system with the addendum an epicycloidal curve as these are frequently



still used. The size of the pin is limited by the gap between the teeth, inasmuch as a tangent to the pin's arc must also be tangent to the tooth curve. These formulas can also be used for figuring the size of pins, when the size over the pins and the tooth dimensions are known.

According to the mathematical relations of the epicycloidal curve:

w = the generating angle of the curve

n = the ratio of the radius of the roll circle to the radius of the pitch circle (generally $n = \frac{1}{2}$)

DP is perpendicular to BP as tangent and normal

arc BP = arc BA

Thus angle $BCP = \dfrac{w}{n}$

and angle $BDP = \dfrac{w}{2n}$

Therefore angle $DBP = 90 - \dfrac{w}{2n}$

angle $OBP = 90 + \dfrac{w}{2n}$

angle $BEO = 90 - \left(\dfrac{w}{2n} + w + \gamma\right)$

and $BP = 2nr \sin \dfrac{w}{2n}$

Furthermore:

$$\frac{2nr \sin \frac{w}{2n} + R}{r} = \frac{\sin (w + \gamma)}{\sin \left[90 - \left(\frac{w}{2n} + w + \gamma\right)\right]}$$

$$\frac{\sin (w + \gamma)}{\cos\left(\frac{w}{2n} + w + \gamma\right)} - 2n \sin \frac{w}{2n} = \frac{R}{r} \qquad (1)$$

With the most common practice ($n = \frac{1}{2}$):

$$\frac{\sin (w + \gamma)}{\cos (2w + \gamma)} - \sin w = \frac{R}{r} \qquad (2)$$

Also

$$\frac{x}{r} = \frac{\sin\left(90 + \frac{w}{2n}\right)}{\sin \left[90 - \left(\frac{w}{2n} + w + \gamma\right)\right]}$$

$$= \frac{\cos \frac{w}{2n}}{\cos \left(\frac{w}{2n} + w + \gamma\right)}$$

$$x = r \frac{\cos \frac{w}{2n}}{\cos\left(\frac{w}{2n} + w + \gamma\right)} \qquad (3)$$

and with $n = \frac{1}{2}$:

$$x = r \frac{\cos w}{\cos (2w + \gamma)} \qquad (4)$$

Because (1) and (2) are transcendental equations they cannot be solved directly. The indirect solution of these equations will be shown best by an example.

Gear with 12 teeth — D.P. = 2

Pitch circle = 6 in.; $r = 3$ in.

Roll circle = $\frac{1}{2} r = 1\frac{1}{2}$

Pin diameter = $1\frac{1}{4}$; $R = 0.625$

$$\alpha = \frac{360^\circ}{\text{Number of teeth}} = \frac{360^\circ}{12} = 30^\circ$$

$$\gamma = \tfrac{1}{4}\,\alpha = 7^\circ 30'$$

As $n = \frac{1}{2}$ we can use Equation (2)

If we write (2) in the form:

$$\frac{\sin (w + \gamma)}{\cos (2w + \gamma)} - \sin w - \frac{R}{r} = 0$$ and let:

$$y = \frac{\sin (w + \gamma)}{\cos (2w + \gamma)} - \sin w - \frac{R}{r} \qquad (5)$$

we have to find a value of w which makes y equal zero.

Assume w to be 15° and get:

$$y = \frac{\sin 22\frac{1}{2}^\circ}{\cos 37\frac{1}{2}^\circ} - \sin 15^\circ - \frac{0.625}{3} = 0.01520$$

Similarly:

$w = 14°$ $y = -0.00007$
$w = 14° 2'$ $y = +0.00040$

By simple interpolation, we get now an accurate:
$w = 14° 0' 18''$

And:

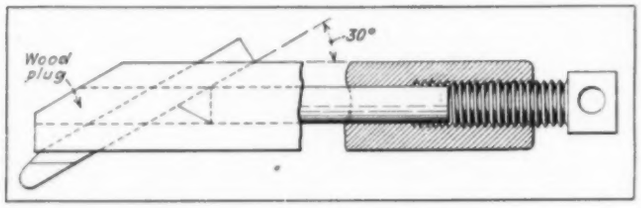
$$x = r \frac{\cos w}{\cos (2w + \gamma)} = 3 \frac{\cos 14° \ 0' \ 18''}{\cos 35° \ 30' \ 36''}$$

Therefore: $x = 3.5758$

A Safety Boring Bar

J. T. TOWLSON
London, England

In the good old days, what tools the workmen could not get, they had to learn to do without. For many years, such a boring bar as is illustrated has been known to be of particular service, especially since the cutter can be adjusted while the operator's hands are in a much safer



position than if it were held by a setscrew at the forward end of the bar. But in the old days, such a bar was not easy to make. Seamless tubing for the body was not procurable; neither were twist drills of adequate length to drill the hole in the body.

Now, such a bar can be made in a short time. A piece of seamless tubing, 1 in. in outside diameter having a $\frac{3}{8}$-in. hole the full length, and a square hole for the cutter; a gripping pin, as shown; and a toolbit, are readily available to make such a bar.

Relation of Die Clearance to Metal Thickness—*Discussion*

L. G. PATTERSON
Factory Superintendent, Armstrong Machine Works

In an article by John J. McHenry (*AM*—Vol. 75, page 495), the author has given an interesting article on proper clearances for punch and dies. His statement that, "burrs are rarely formed because of excess clearance, except in metals that are extremely soft or of light gage," is too broad to let pass without some comment. There are hard metals that require close fitting of blanking dies to eliminate the burr.

We have been using, for the past three years, 18-8 metal or the so-called stainless steel under the trade names of Uniloy, KA2, Askaloy, and others. We have found in blanking this metal, which has a Rockwell test of around B60, that the punch and die have to be fitted with practically no clearance even in blanking $\frac{1}{8}$-in. metal, or it will throw a burr in proportion to the amount of clearance between the punch and die.

SEEN AND HEARD

JOHN R. GODFREY

Paint That Sticks to Galvanized Iron

So many industrial users of paint for galvanized surfaces have had difficulty in finding a paint that will adhere firmly to such surfaces that much research has been devoted to the development of a satisfactory paint for this purpose. According to H. A. Nelson, a research chemist with the New Jersey Zinc Co., a very satisfactory paint for this purpose is produced by mixing four parts of zinc dust and one part of zinc oxide (by weight) in a vehicle containing 80 per cent raw linseed oil, 15 per cent thinner and 5 per cent oil dryer. Even without cleaning or etching the surface, which is usually recommended before painting galvanized steel, this paint has withstood a southern exposure for five years, and still the paint cannot be flaked from the surface.

Special care is necessary in grinding and in packing this paint. A linseed oil of low acid number must be used. A soft rubber gasket must be used to seal the container, and the latter must not be filled completely. Otherwise the gases formed, chiefly hydrogen, may burst the container. These gases, however, disperse slowly through a rubber gasket. The same paint is useful also on black sheet and is said to offer more effective resistance to corrosion than any other standard metal priming paint. The New Jersey Zinc Company makes only pigments for such paint, but the finished paint doubtless is available from many paint manufacturers.

Twofold System of Measurement

Under this title, the "Scale Journal" for September divides standards of measurement into "legal" standards and "private" standards. Legal standards are required and used in transactions involving measurement in which the interest of the public is involved. Legal tolerances are coupled with these legal standards. Private standards are such as are used by manufacturers, and in their use the interest of the public is not involved. Private tolerances are coupled with these private standards. Private standards and tolerances can never be a legitimate subject of legislative enactment. In the U. S. Bureau of Standards there seems to be some confusion between legal and private standards, and though the Bureau can legitimately act as sponsor for private engineering standards, care should be taken that these non-public standards are not written into Acts of Congress.

Radical Changes Cost Money

Large scale production involves a lot of problems for management. Investment in special machines greatly reduces costs but must be amortized before a change in product design makes them obsolete. Standard machine costs can be spread over several years, but a radical change may make highly specialized machines a white elephant unless the saving has been abnormally high. Radical changes in design nearly always mean a higher production cost because of necessary machine investment. That is one reason we are not likely to see tear-drop or other radical automobiles just now.

SHOP EQUIPMENT NEWS

Barber-Colman Type A Hobbing Machine

Carrying further the design principles of the No. 12 hobbing machine, the Barber-Colman Co., Rockford, Ill., has introduced the Type A hobbing machine which is more sturdy, has a slightly greater capacity, and contains in one machine the various attachments that have heretofore been marketed as separate units for its predecessor. The Type A machine is also more accurate, made possible by the greater accuracy built into the spindle indexing mechanism. It is of greater capacity both as to diametral pitches and the length of the work that can be placed on the arbor.

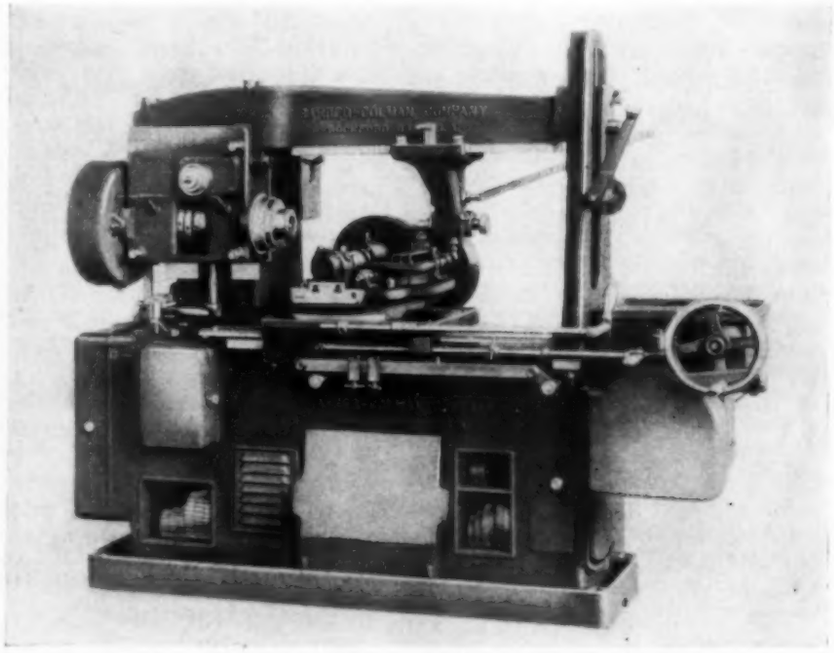
The horizontal, forged-steel work spindle runs in double opposed taper bronze bearings, independently adjustable. The work arbors are securely held in position by a draw-in bolt passing through a $1\frac{7}{32}$-in. hole, enlarged to a No. 12 B & S taper at the front. Carried on the taper gibbed ways on the front of the upright is the work spindle slide, adjusted in position by an elevating screw. This slide carries the index worm and wormgear mechanism in an oil-tight case. Work arbors are supported at the outer end by an overarm bracket or tailstock, sliding on dovetail ways and provided with a clamp handle and a rapid unloading device. This bracket may be fitted with an adjustable steel center or with a bronze bushing to receive a steel sleeve clamped on the work arbor.

The rapid-handling device, mounted on the overarm brace, consists of a double lever and crank mechanism with an adjustable linkage connected to the overarm bracket. The lever on this linkage goes over center when the overarm bracket is pushed toward the work spindle nose, and there is a yielding connection where the linkage meets the bracket, producing a predetermined pressure while the bracket is being clamped. The overarm itself is bolted securely to the top of the work spindle slide, and the outer end is clamped in a slot in the overarm brace, which is fitted to the bed of the machine.

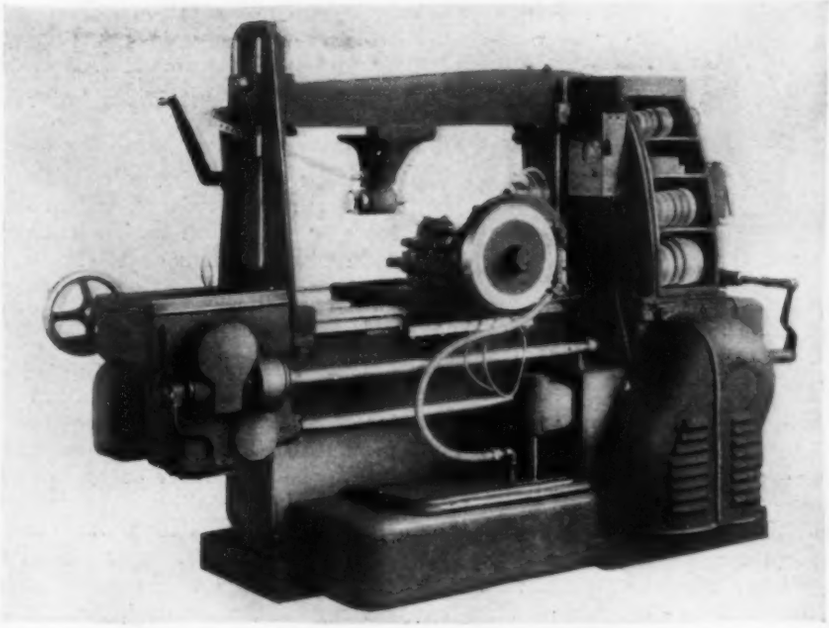
Index means on this machine are the same as those of the No. 12 hobber, namely, a worm and worm gear mounted in a case on the work spindle slide. Drive to the worm is by a vertical shaft with a long keyway which takes care of up and down movements of the slide. The worm is carried in separate bearings, and by means of adjusting screws, may be moved closer to the worm gear to take up any wear that develops.

Timken tapered roller bearings are used for the hob spindle, which is of alloy steel, hardened and ground. It is mounted in an independent slide which is clamped to the swivel by taper gibs. Another taper gib between this slide and the swivel makes the connection between the pinion and the driving gear adjustable. Provision is also made for lengthwise movement of the slide by means of a micrometer screw to relocate the hob after it has become dull in one position. Extra long ways are provided for the hob swivel slide, which is also taper gibbed for wear adjustment. Felt wipers are built into the slide to protect the bedways, and in addition, heavy, stationary, sheet steel way guards act as a roof over the bedways to keep them free of chips. A range of helical settings 50 deg. either side of zero is provided, with a vernier reading for close adjustment.

Longitudinal movement of the slide is accomplished by a steel feed screw in the bed of the machine engaging a bronze feed nut built into the slide. This feed screw is driven from the feed box and can be revolved in



Evolved from the No. 12 is the Barber-Colman Type A Hobbing Machine, which is somewhat sturdier, has slightly greater capacity, and embodies all attachments



Rear view of Barber-Colman Type A hobbing machine, showing the rapid loading device on the work arbor, the coolant tank, inclosed motor drive, and the feed box drive

either direction at normal working speed or for rapid traverse. A handwheel is also provided for manual movement.

In order that the hob will move steadily forward without jump or chatter, an automatic "stabilizer" has been built into the bed and is arranged to give a steady frictional drag or resistance to the hob swivel slide. The stabilizer may be disconnected when it is desired to traverse the slide by hand, as when setting up new jobs. In effect a braking device, the stabilizer eliminates backlash in the feed screw and prevents the slide from jumping when the hob chatters in the work. Its action is automatic in both directions, producing a uniform drag and cutting stroke and returning itself to the starting position on the return stroke.

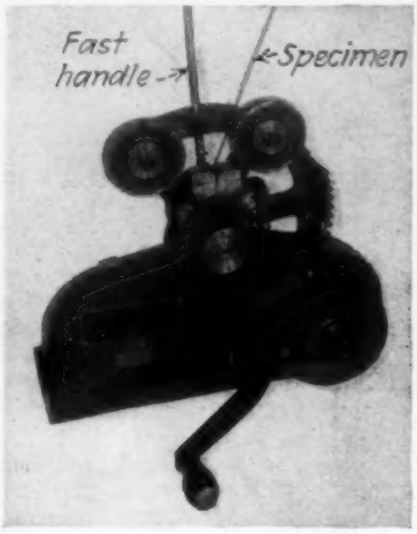
The feed of the hob swivel slide traverse is by a feed box at the right-hand end of the bed. Power is taken by a shaft on the back of the machine and transferred by a pair of bevel gears to the feed change gears located on the front of the box. This train of change gears drives a worm engaging a worm gear mounted on the feed screw. This feed mechanism is interlocked with the index drive so that spiral gears may be cut as well as spur gears. The rest of the mechanism in the feed box consists of the constant running drive for the rapid traverse, which is 70 in. per minute at the slide. In the feed box there is also a mechanism for manual operation of the feed screw by means of a handwheel, arranged with an automatic throw-out so that it does not revolve when the machine is in operation. Sufficient change gears are provided for eight different speeds of the machine.

A centrifugal coolant pump is furnished as regular equipment. Drive of the machine is by a constant-speed, 5-hp. motor, adjustably mounted in the base of the machine under the upright. On the main shaft, which is connected to the motor by a silent chain drive, is a multiple disk clutch for disconnecting the feed and index drives.

A combination of automatic stops is provided so that the machine may be set for almost any desired series of operations. Stops on both feed and rapid traverse mechanisms are available, and an additional stop automatically throws the clutch on the main drive at the end of the cut.

Warner Reverse Bending Machine

A reverse bending machine for testing small rods and flat specimens can be supplied by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. Operation of the machine consists in bending a specimen back and forth over definitely shaped jaws so that smooth bending in opposite directions is



alternately effected. This operation is usually done by means of the geared handwheel, but may be speeded up on thin work by using the hand-operated bar at the top of the machine.

Turner No. 39-A Blowtorch

The No. 39-A blowtorch with a one-quart fuel tank has been announced by the Turner Brass Works, Sycamore, Ill. It is claimed to be

impossible to jam the orifice. The cleaning needle and orifice block can be replaced. Cool composition valve handles are a feature, and the drip cups can be filled through the lower priming valve.

Thompson Hydraulic Surface Grinder

Fully hydraulic operation is featured in the 12 x 16 x 40-in. surface grinder announced by the Thompson Grinder Co., Springfield, Ohio. The table is actuated by a hydraulic cylinder and may be reversed either by table dogs or manually at any point of its stroke. The wheelhead is traversed hydraulically at both ends of the table reverse and is controlled by a valve. Cross feed to the head is hydraulically actuated and is automatic in operation, acting at both ends of the stroke. Feeds from $\frac{1}{32}$ to 2 in. per reverse are obtainable, thus permitting fast removal of stock at high speeds. The wheelhead is also equipped with a hydraulic valve which is employed to actuate the wheel dressing device. The standard wheel (10 x 3 x 5-in. hole) is mounted upon a chrome-nickel steel spindle which revolves in adjustable bronze bearings. End thrust is taken by a hardened thrust collar. A precision, balanced rotor is keyed directly to the spindle, thus eliminating vibrations induced by indirect drive. The wheelhead may be raised or lowered by means of a handwheel, the micrometer index permitting increments of 0.00025 in. to be obtained.

The table oil pump is located in the base and is driven by a 3-hp. motor with V-belt drive. A generator of sufficient capacity for a full-size magnetic chuck may also be mounted in the base and driven from this motor. The wheelhead motor and the table drive motor are separately controlled by push buttons and are protected by overload relays.

All functions of the table are controlled by means of one lever located in the valve panel in the front of the base. The table has an infinite speed range from 20 to 100 ft. per min. Automatic pressure lubrication to the table is provided to minimize wear on the ways.

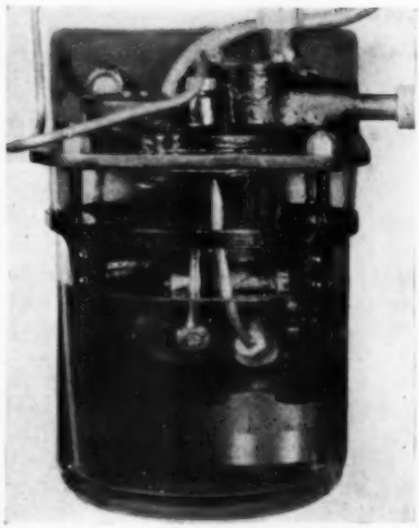
The height of the machine is 85 in.; the floor space for extreme travel is 112 in. long x 55 in. wide, and the weight with motors is 7,000 lb.

Bijur Automatic Industrial Lubricating Pump

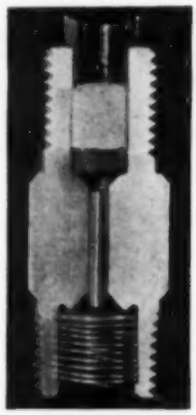
A compact pumping unit for industrial lubricating systems has been developed by the Bijur Lubricating Corp., 22-08 Forty-Third Ave., Long Island City, N. Y. This unit consists of two main elements, a small gear pump and a timing mechanism to determine the amount of oil delivered at definite intervals. These elements are mounted on a casting that may be mounted in a glass reservoir or a metal reservoir with integral oil level gage. If desired, a reservoir may be cast at a convenient place in the frame of a machine.

The input shaft is operated by direct, belt, or chain drive from some rotating shaft on the machine to give a rotation of approximately 150 r.p.m. This movement is transmitted through spiral gears to the small gear pump. The pump draws oil through a very dense felt filter. Driven from the same shaft, by means of a train of gears having a reduction of 3,750 to 1, is a cam making one revolution every 25 min. Engaged with this cam is a follower which operates a pressure valve in the circulating oil line. When the follower meets a depression in the cam, the pressure valve is operated and the oil flow diverted to the pump outlet for a period of 10 to 30 sec. More frequent intervals of discharge are obtained by modifying the cam. Mounted in the top of the pump unit is a screw adjustment, by means of which the pressure on the system may be increased or decreased as required.

From the pump a single line of $\frac{5}{32}$-in. copper tubing is led around the machine. Branch lines are taken from this main line to the drip plugs at the bearings. A maximum of approximately 6 cu.in. per min. of oil is available if required. A button is provided on top of the unit which gives continuous feed of oil when depressed.



Bijur Automatic Industrial Lubricating Pump Unit mounted on a glass reservoir

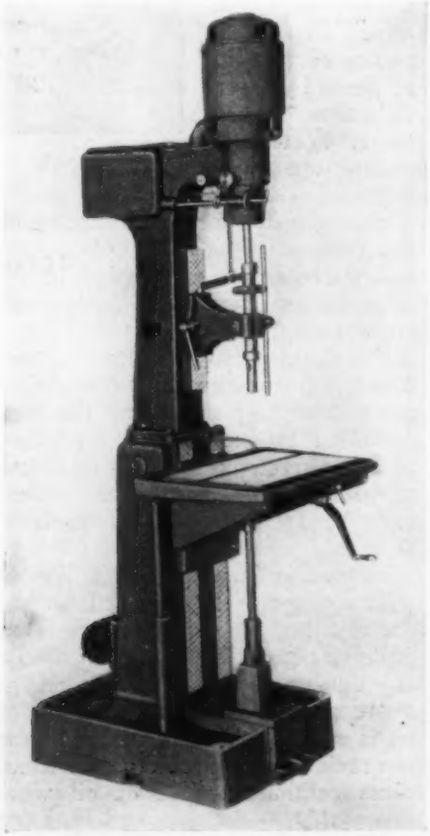


Bijur drip plug section, showing felt filter, restriction pin made for flows of $\frac{1}{2}$ to 46 drops per min., and oil pressure-operated vaive

Allen No. 2 Motor-Spindle Drilling Machine

From one to six spindles and overhangs of 8, 12 and 15 in. are available in the No. 2 motor spindle drilling machine built by the Chas. G. Allen Co., Barre, Mass. The motors are built directly on the spindles and are of the constant-torque type. They are wound for four speeds in two distinct speed ranges; 600, 1,200, 1,800 and 3,600 r.p.m., or 600, 900, 1,200 and 1,800 r.p.m. The drum-type controller for changing speeds is mounted in the compartment at the rear of the motor where it is readily accessible. In addition to the four open motor speeds, four reduced speeds may be obtained through ball-bearing, heat-treated backgears of the sliding type. Any reduction ratio up to a maximum of 4 to 1 can be furnished.

A dial on the controller shaft indicates the speed being used, either direct or backgeared. An automatic interlock prevents shifting the backgears except when the controller is in the "off" position. Power feed change gears, as well as the ball-bearing backgears, are inclosed within the housing and are automatically lubricated. Standard equipment includes individual motor protection and an inclosed magetic switch operated by a treadle at the front of the base for starting and stopping all spindles. A coolant tank is placed in the base, and the coolant pump is driven by an individual fractional-horsepower motor.

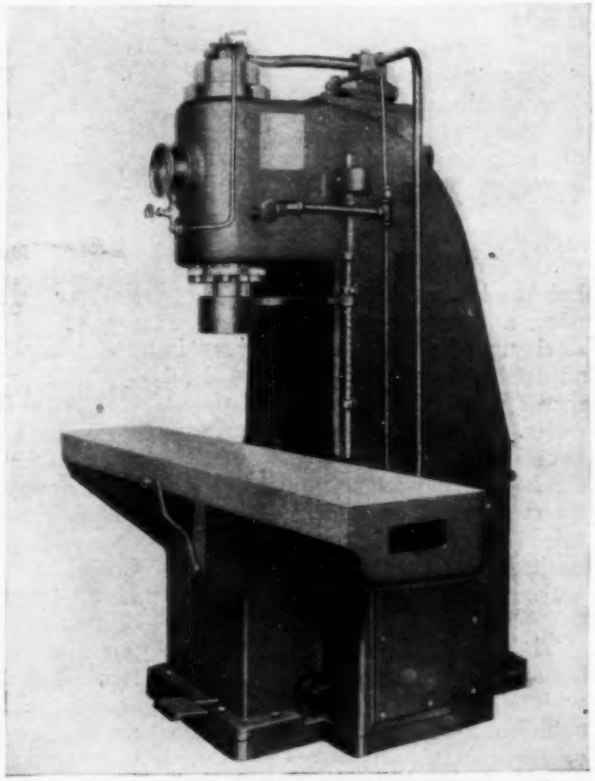


General specifications of the No. 2 motor-spindle machines are practically the same as for the No. 2 belted spindle machines, the principal exception being the center-to-center distance of the spindles, which is 12½ in. instead of 10 in.

H-P-M Oil-Pressure Assembling Presses

A series of hydraulic presses to be used chiefly as quantity-production machines for general shop pressing operations has been developed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The assembling press is of the open-gap type to provide easy access to the work from both sides as well as from the front. The press frame is a heavy one-piece casting with a deep section. Oil storage is provided by a cavity in the upper section of the press frame. The oil is employed as both pressure fluid and lubricant.

The power unit is completely inclosed, and the pressure pumps are mounted on the baseplate. The inclosed arrangement not only makes for neatness, but also a 50 per cent saving in floor space is obtained. Access to the interior is through openings on each side. The operating system consists of a rotary type, low-pressure oil pump which advances the ram to the work rapidly, and a radial-type, high-pressure oil pump for generating the full working pressure to drive the press ram. Both are driven from one electric motor. Two forward speeds are provided—a rapid closing speed and a slower, full-load pressing speed that is automatically controlled through a single manually operated lever. Over-travel is impossible since the pump discharge is automatically diverted when extreme ram travel is reached. At any point in the ram travel, it is necessary only for the operator to release the lever to allow the ram to return to its neutral position where it automatically stops.

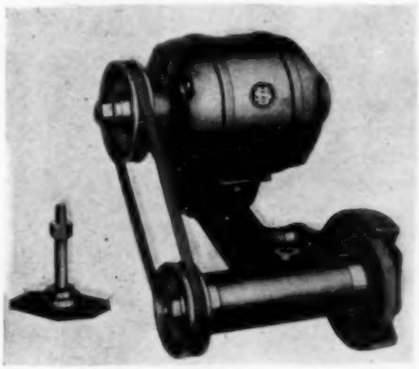


Capacities of 15 to 200 tons are available for assembling, straightening and broaching operations

These presses are for assembling, straightening, broaching, or other operations, and are available in seven capacities from 15 to 200 tons, and with either square or extended beds.

"U. S." Lathe Grinder

Built for lathes having swings of 9 in. and up and also having a compound rest, a lathe grinder has been developed by the United States Electrical Tool Co., Dept. 44, 2489 West Sixth St., Cincinnati, Ohio. This lathe grinder is used especially



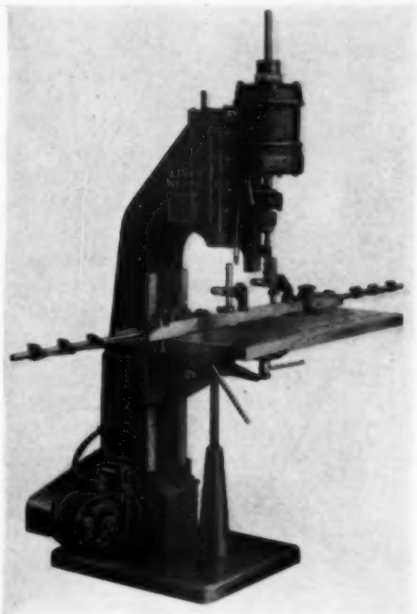
for grinding centers, reamers, dies, rolls, small shafts and similar equipment. It can also be used on shapers, planers and boring mills. The motor is of ¼ hp., and has a speed of 5,200 r.p.m. It is built for 110 or 220 volts, a.c. or d.c., and for 1, 2 or 3-phase a.c. Ball bearings are employed, and rotating assemblies are balanced to give vibrationless operation.

Cutler-Hammer Rubber Attachment Cap with Hand Grip

An unbreakable attachment cap with hand grip has been announced by Cutler-Hammer, Inc., 205 North 12th St., Milwaukee, Wis. This cap is made of soft, resilient rubber with the blades fastened to a Bakelite disk imbedded in the rubber base. The hand grip is approximately 1¾ in. long. It is said that the resiliency provided by the rubber handle will act as strain-relief protection to the cord, as well as to prevent the cord from breaking directly at the cord hole. The cap is suitable for industrial application and is rated at 15 amp., 125 volts or 10 amp., 250 volts, and is known as Cat. 7761. It is available with cord openings for $\frac{11}{32}$- and $\frac{13}{32}$-in. cords.

Oliver No. 272 Single-Spindle Vertical Wood Borer

A stationary head with a reciprocating spindle is the feature of the No. 272 single-spindle vertical wood borer developed by the Oliver Machinery Co., Grand Rapids, Mich. This machine is built for power feed or foot feed or a combination of the two.



Power feed is used on the machine illustrated. Capacity of the machine is for boring holes up to 2 in. in diam. any depth up to 6 in. in the center of 33-in. diam. stock with the power feed, and the same diameter up to 9 in. deep when using the foot feed.

The table is adjustable up and down and can be tilted to the right or left, forward or backward, and also moved horizontally toward or away from the operator. The automatic feed gives the operator a choice of three speeds, which are 12, 18 and 26 strokes per min, to the spindle.

The boring head motor is a ball-bearing, 2-hp. design, running at 3,600 r.p.m. A fan built into the motor directs a blast of air to the boring tools and clears away the chips.

Olsen Motor-Driven Brinell Hardness Testing Machine

Improved design of its motor-driven Brinell hardness testing machine has been announced by the Tinius Olsen Testing Machine Co., 500 North 12th St., Philadelphia, Pa. Provision is made by means of a lever device on the side to permit operating

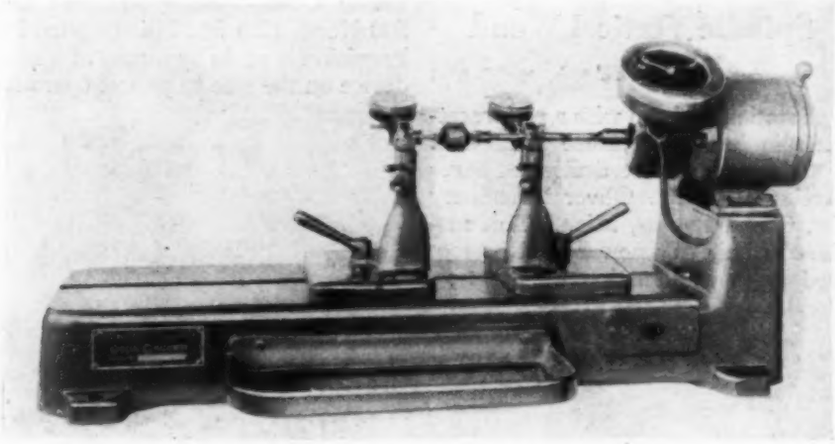
by means of a treadle. Foot operation is effected by adjusting a rod running downward from the segment on the lever. All rotating parts are completely inclosed and run in oil.

Brown & Sharpe Straight-Shank, Spiral, Two-Lipped End Mills

A line of end mills with spiral teeth having greater cutting areas has been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. These two-lipped end mills are of the straight shank type, and are furnished in high-speed steel, both right and left hand, and are made in a complete range of sizes. The diameters range from ¼ to ¾ in., and the length of cut from ⅜ to 1⅛ in. The shank is the same diameter as the cut taken.

Globe Dynamic Balancing Machine

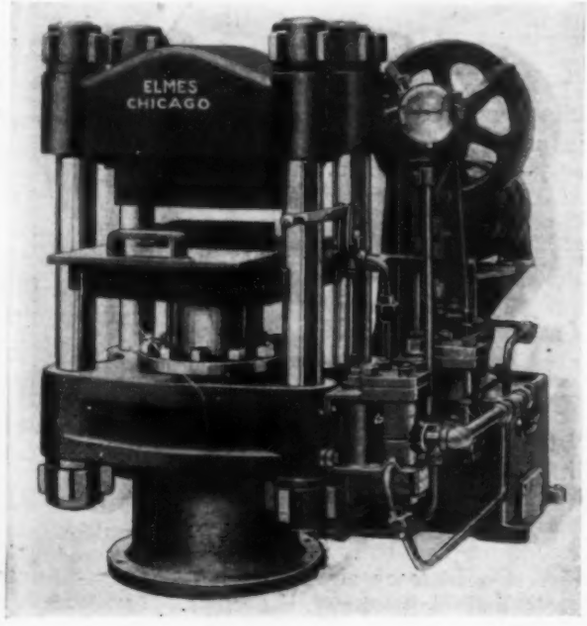
A so-called "super-sensitive" balancing machine of the dynamic type has been developed by the Globe Tool & Engineering Co., Dayton, Ohio, and light to locate the spot of unbalance. The type of machine illustrated is useful in balancing small series-wound armatures such as used in vacuum cleaners, electric drills, and other tools of this character. The location of the unbalanced force is found electrically by using only one direction of rotation. The amount of unbalance is read automatically at the time the location of unbalance is found, which is usually 30 sec.



it is available in sizes to balance work from 1 in. to 96 in. in diameter, and to accommodate weights as low as ¾ oz. or up to 2,000 lb. It employs neon

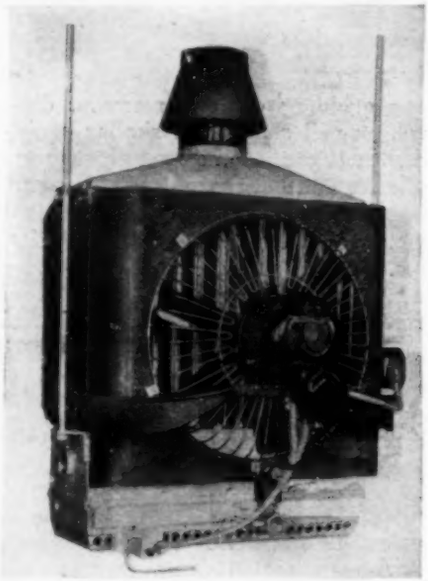
Elmes No. 3544 Hydraulic Press With Automatic Control

The No. 3544 hydraulic press built by the Charles F. Elmes Engineering Works, Morgan & Fulton Sts., Chicago, Ill., is equipped with an automatic control which allows the operator to give maximum attention to the work done and minimum attention to the operation of the press. In this instance, the press is of 200 tons capacity and is operated by a vertical two-pressure pump. The controlling mechanism can be applied to any size single-acting press with any type of pump, whether single or double pressure. It can also be applied to rotary pumps, as well as to reciprocating pumps. The operator simply has to depress the starting lever and the press ram moves upward, automatically bypassing the low pressure at the proper time, and then automatically reversing the press after the required pressure has been exerted. A slight change in the adjustment allows the press to function so that the low pressure bypasses automatically as before and then the press reverses after the ram has traveled a specified distance. In either case, the pressure or the stroke of the ram is readily adjustable.



Surface Combustion Gas-Fired Unit Heaters

Unit heaters of the gas-fired type for heating industrial buildings have been developed by the Surface Combustion Corp., Toledo, Ohio. Uniform temperatures and mildly circulated air throughout the buildings may be maintained since these units

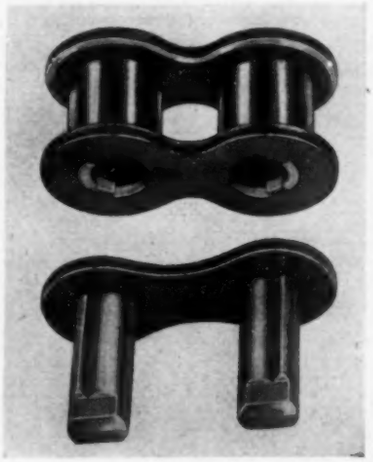


are automatically controlled. They may be used for either natural or artificial gas. The gas supplied to the burners may be turned off during the summer months and the fan on the unit be used for circulating air to give a cooling effect. The heaters are made in three sizes, namely with hourly B.t.u. inputs of 200,000, 120,000, and 60,000.

The heaters consist of a series of Allegheny metal streamline tubes to offer heating surfaces. The gas supply is fed through a spring-loaded regulator which is set for the capacity of the burners desired. The automatic controls, furnished as standard, include the spring-type, gas-pressure regulator, the automatic gas pilot, the mercury bulb switch and the electric solenoid gas valve.

Morse Roller Chain

A roller chain with distinctly different joint construction has been developed by the Morse Chain Co., Ithaca, N. Y. Within the roller there are two joint members, a segmental bushing and a pin. The cross-section of the pin is that of a round pin integral with a segmental bushing. Because of this construction, when a chain is flexing on or off a sprocket, all sliding movement of the surfaces under load is between the pin and its bushing, and no movement occurs between the roller and joint members when under

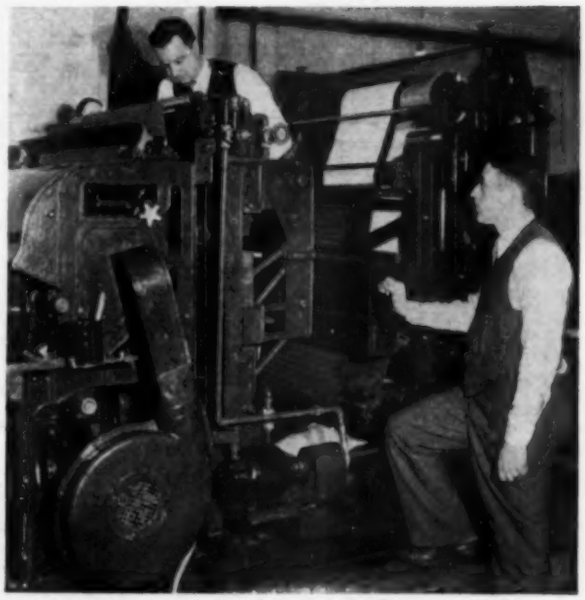


load. This feature insures uniformity of pitch throughout the life of the chain, and smoother and quieter operation.

The open spaces between the joint members provide reservoirs for oil, and lubrication is made more effective by the "pumping" action when flexing. The chain is made to manufacturer's standards and is interchangeable on all standard roller sprockets.

"Kyano" Blueprinting Process

Deep, brilliant printing of blueprints or blue-line prints on either standard or fast printing papers without bleeding or running of blues into whites is accomplished with the "Kyano" process developed by the C. F. Pease Co., 813-821 North Franklin St., Chicago, Ill. Thus, the operator can make blueprints along with blue-line prints at any time and at the same printing speed. The process has eliminated the difficult job of "blocking out" blueline prints when clean white backgrounds are desired. In the case of blueprints which have been under exposed the lines are reproduced in full width, even with fine pencil lines. When using fast printing paper, a good blue color can be secured with clear white lines and it is possible to give these prints a full over-exposure. Thus, by use of this process best printing results can be obtained and advantages of faster production are realized.



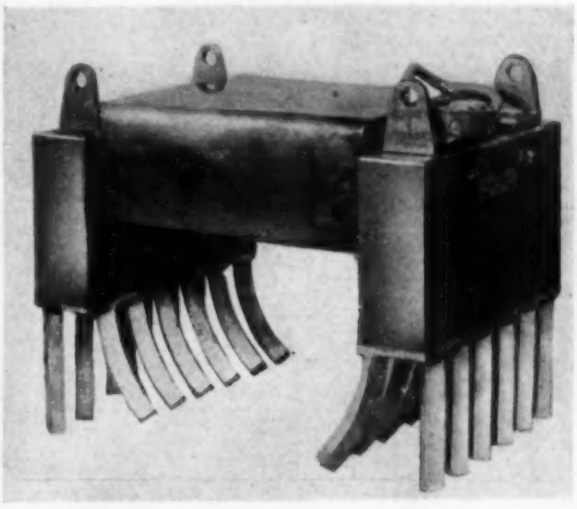
Fast printing papers reproduce fine pencil lines when the Pease "Kyano" attachment is used

Another feature of the "Kyano" process is that it permits the usable life of coated paper stock to be prolonged. Printing speeds need not be changed so often and the exercise of judgment on the part of the operator is not so important in order to obtain a satisfactory blueprint or blue-line print.

The "Kyano" chemical is furnished in dry, pulverized form. The process is carried out by the "Kyano" process attachment which is shipped completely assembled so that installation on any Pease continuous machine can be made within a short time. The attachment is mounted directly at the rear of the blueprinting machine before the first water wash and ordinarily only one plumbing connection is required. Tracings and negatives are fed into the machine in the regular manner. The process is designed to operate on the "Peerless" Model 30 and Model 25 continuous blueprinting equipments and also can be adopted to operate on the older type Peerless Model 20 and Model 10 equipments. The attachment can be shut down on any model to permit running negatives and brown-line prints.

Dings Magnetic Spout for Separating Chips from Cutting Oil

A spout-type magnet is offered by the Dings Magnetic Separator Co., Milwaukee, Wis., for separating chips from cutting oils and other material handled in liquid form. Of necessity, the chips must be of steel or iron to possess sufficient magnetic properties. The spout magnet consists of an electro-magnet of high intensity suspended over a launder. Prongs dip into the cutting oil and the particles of iron are guided by the magnetism to the prongs.



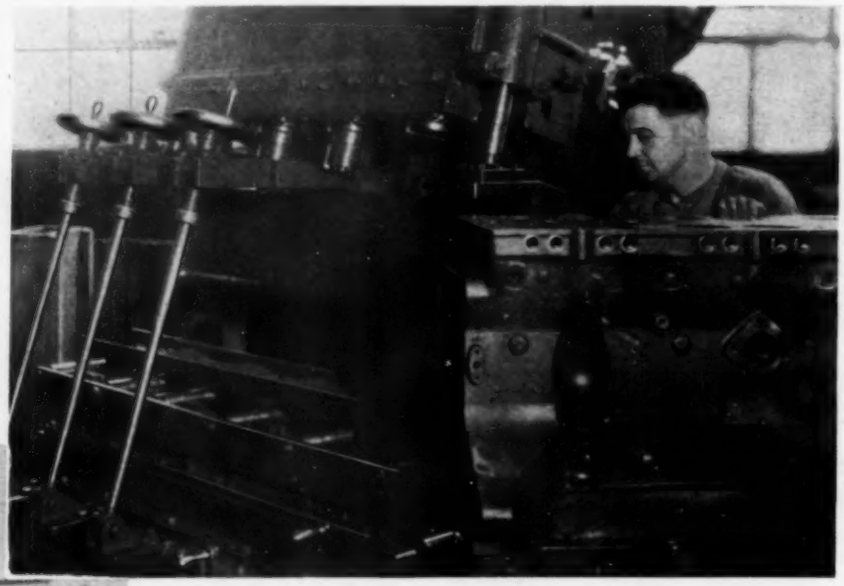
EQUIPMENT ADAPTATIONS

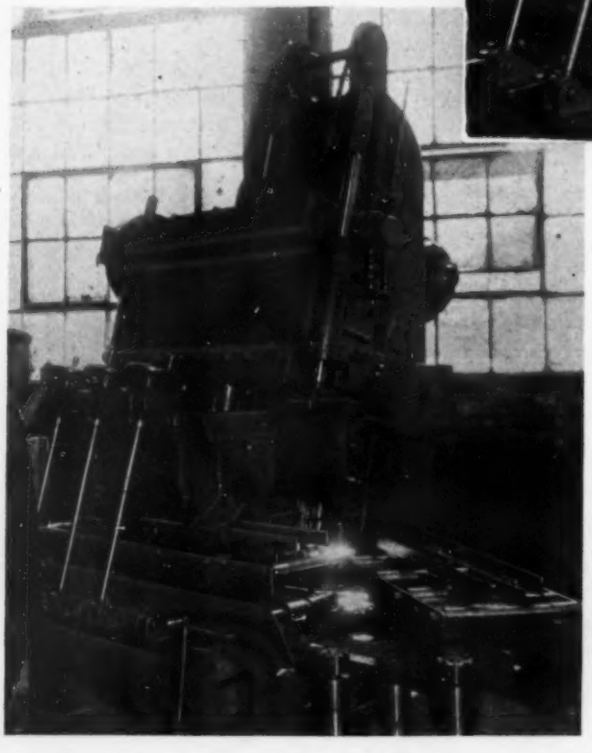
RECENTLY DEVELOPED BY THE MAKERS

Moline Special Cylinder Borer for Large V-Type Blocks

The Moline Tool Co., Moline, Ill., has supplied a special cylinder borer to the American LaFrance & Foamite Corp., for rough boring, finish boring, reaming, and counterboring 8-, 12,- and 16-cylinder cylinder blocks, machining every other hole at one setting, and indexing for the alternate holes. These blocks are especially large, the 12-cylinder block weighing 568 lb., and the two rows of bores are on an angle and must be completed with the minimum amount of handling. The special machine illustrated was built with a turntable to the right of the operator, on which the cylinder blocks are easily turned to reload into the jig for the boring of the second row of cylinder holes. A section of roller conveyor supports the block while in the jig.

One of the features of this machine is that through the massiveness of the heads carrying the boring spindles, it is not necessary to pilot the boring bars either above or below the work. The block is rough bored, finish bored and reamed to 4.250 in., and counterbored to 4.260 in. The feed is adjustable through an Oilgear installation. Three changes of spindle speed are provided with pick-off change gears, giving 60 ft. per min. for roughing and semi-finishing, 25 ft. per min. for counterboring, and a third speed 45 ft. per min. as an intermediate. The entire stroke, or travel of the rail is 24 in. Both the spindles and the Oilgear unit are driven by a 30-hp., 1,800 r.p.m. motor through silent chain drive. The machine weighs approximately 30,000 lb. and the over-all height is 10 ft.





Close-up of the cylinder boring machine, showing the operator turning the block on the turntable, and giving a general view of the jig and the cutters

Special cylinder boring machine developed by the Moline Tool Co. for rough boring, finish boring, reaming and counterboring large American LaFrance & Foamite 8-, 12- and 16-cylinder cylinder blocks

TRADE PUBLICATIONS

DIE MAKING MACHINES. The Oliver Instrument Co., Adrian, Mich., has issued a 12-page catalog on its improved die making machine, giving the principle of operation, descriptions of the various sizes with their specifications, and also illustrating other machines such as drill grinders, cutter grinders and tool grinders.

MERCHANTS' YEAR BOOK. The Merchants' Association of New York, Woolworth Bldg., 233 Broadway, New York, N. Y., has issued its 1931 Year Book which covers its membership of 6,000 and gives an alphabetical and classified compilation of prominent concerns in the trades, industries and professions. Branch offices of out-of-town concerns are also listed. The year book contains 246, 7x10-in. pages.

MOTORS. The Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio, has issued Bulletin No. 210 on Type T two-pole d.c. motors.

MOTOR DRIVES. The Hertzler & Zook Co., Belleville, Pa., has issued a catalog illustrating and describing its individual motor drives for machine tools and other machinery. The variety of drives are offered for a wide range of belt-driven tools that may be modernized by drives bolted to the machine.

PROCEDURE IN PLATING ROLLED ZINC AND ZINC DIE CASTINGS

1. BUFFING

Buff on cloth wheel, using free cutting tripoli.
Color on cloth wheel using soft, dry white compound.
Use peripheral speed of 5000-6000 feet per minute.

Precautions

- Avoid grinding on die castings as outer skin presents densest surface for plating.

2. CLEANING

Use trisodium phosphate solution, boiling hot as electro cleaner (6 oz. per gal.). Make article cathode. Use sufficient current to cause gassing. For recessed articles, a dip in Xylene prior to this cleaner is effective in removing grease.

- Thoroughness in this step will avoid peeling and blistering in nickel.
- Do not add sodium hydroxide or sodium cyanide to cleaning solution.

3. RINSE

Use alternate hot and running cold water.

4. ACID DIP

Use 1% Hydrofluoric acid or 5-10% Hydrochloric acid cold dip. Dip one minute or until surface is slightly etched.

- The acid dip will compensate for minor faults in cleaning and will also remove any zinc salts formed by the cleaning solution.
- Etched surfaces improve the adherence of plated coatings.
- Avoid discoloration.

5. RINSE

Use running cold water rinse.

- Make this rinse thorough as carry over of Hydrofluoric acid to nickel bath produces an undesirable type of anode corrosion.

6. NICKEL PLATING SOLUTIONS
All Amounts in Ounces per Gallon

	2 Oz. Bath (Regular Bath)	3 Oz. Bath (Rapid Bath)
Single Nickel Salts	10	15-18
Anhydrous Sodium Sulphate	10-15	15
Ammonium Chloride	2-3	3
Boric Acid	2	2
pH Range—Colorimetric	5.8-6.2	5.4-5.9
Temperature	Room	24-30°C.
Plating range—amps./sq. ft.	12-20	24-36

- Apply a nickel coating at least .0003" thick.
- If peeling occurs look to your cleaning.
- Apply a substantial coating of nickel before plating with brass, copper, bronze, silver or gold. These coatings applied direct are readily absorbed by the zinc base.
- Check pH daily.
- Check nickel content once each week.
- Agitate cathode to prevent burning and pitting. Agitation permits use of higher current densities.
- In order to obtain deposits of reasonable thickness and corrosion resistance in recesses the use of auxiliary anodes is recommended.
- If streaking occurs, raise current density. If streaking occurs at high current density, the solution must be purified.

(See page 9—The Plating of Rolled Zinc and Zinc Base Die Castings—by The New Jersey Zinc Company.)

7. RINSE AND DRY

Use running cold water, rinse and dry thoroughly in saw dust, hot water, or whale oil soap solution.

8. COLORING

Color the primary nickel coating with dry, white nickel coloring compound on cloth wheel.

- A high lustre on the colored nickel will prove advantageous in securing a bright chromium finish.
- Avoid excessive time between coloring nickel and plating with chromium.

9. CLEAN AND RINSE

Use procedure as outlined in steps number 2 and 3.

10. CHROMIUM PLATE—SOLUTION

$Cr\ O_3$ ..... 33 oz. per gallon
$H_2\ SO_4$ ..... 0.33 oz. per gallon
or
$Cr\ O_3$ ..... 33 oz. per gallon
$Cr_2\ (SO_4)_3$ ..... 0.44 oz. per gallon

Use at temperature 45°C.
Current density—75-150 amperes per square foot.
Time—(3 to 6 minutes).
Anodes—(Lead).
Specific gravity—1.17-1.18 grams per cc.

- Scour anodes at regular intervals.
- Check specific gravity, maintain at 1.17-1.18 grams per cc.
- If temperature exceeds 45° C (113° F) higher current densities must be used for good covering and brightness.
- When plating chromium direct on zinc, with no nickel undercoat, it is advisable to plate for 20 to 25 minutes to secure a good corrosion resistant coating.

STRIPPING SOLUTIONS

NICKEL		CHROMIUM
Water	1 part	Make articles to be stripped the anode in any alkaline cleaning solution. A tank separate from the cleaning tank should be used.
Sulphuric Acid	2 parts	
Nitric Acid	1 part	
Hydrochloric Acid	1/16 part	

11. RINSE AND DRY

Use running cold water rinse and dry thoroughly as in step No. 7.

12. COLORING

Color the chromium with chromium finishing compound.

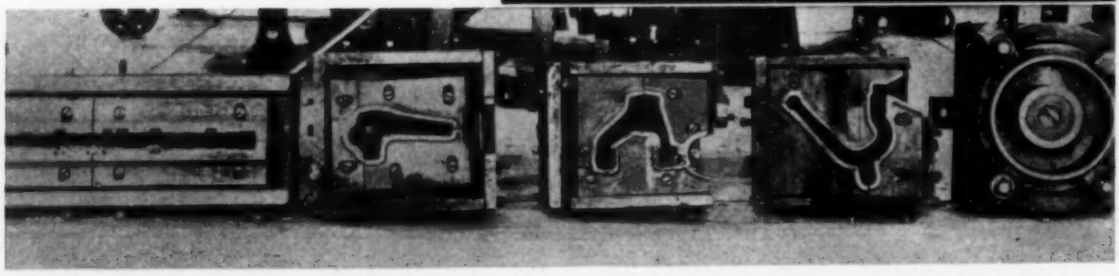
- Color with finishing compound for added lustre and to remove chromium stains.

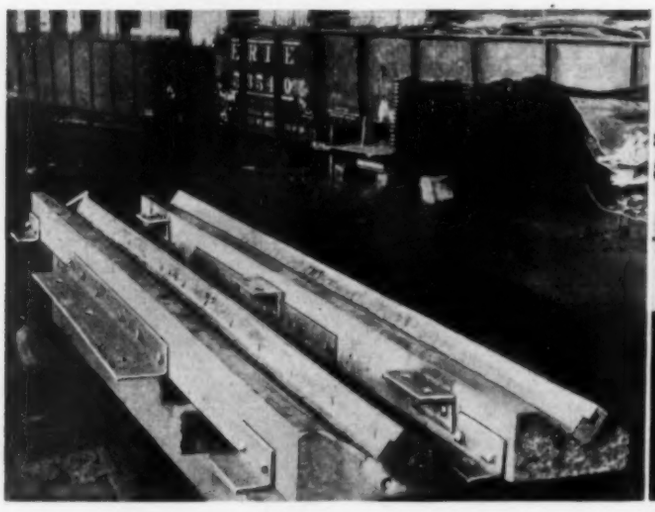
Courtesy of New Jersey Zinc Company

The possible effect of any patents on the methods of formulas recommended in this chart should be considered by the plater.

© American Machinist

Hard Faced Dies





TWO methods are commonly used for producing hard wearing faces or surfaces on blanking dies: welding on of a hard material such as Stellite, or plating with chromium. Illustrated are a series of dies surfaced by the former method. Resulting increases in die life in many cases run as high as 12 to 1, as well as producing cleaner blanks, reducing blanking power required, and cutting die costs greatly. The non-ferrous hard-facing material, available as a welding rod, is usually applied by the oxy-acetylene process.

A large Mid-West forging plant uses the hard-faced hot trimming die illustrated at the top of the page for trimming auto-truck ring-gear forgings. The die, $10\frac{3}{16}$ in. in diameter, is made of vanadium steel with the hard-facing alloy welded to the cutting edge. Its life is 21.5 times that of the plain steel die. The series of dies directly below it are used in the manufacture of a popular make of automobile.

The dies at left below are used for bending right angles of $\frac{3}{16}$-in. plate for box-car ends. They are over 9 ft. long and are hard-faced for their entire length to a depth of $\frac{3}{16}$ in. and a width of $\frac{3}{4}$ in. The final illustration shows a difficult blanking die shape ordinarily very short lived. Its life was tripled by hard facing. Similar treatment lengthens the lives of hot punching, forming and trimming tools of a wide variety of shapes and often permits salvaging of old dies.

AMERICAN MACHINIST

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, November 5, 1931

VOL. 75 No. 19

Time for Action

For nearly two years economists, sociologists, industrial executives and labor leaders have been discussing means of distributing what work there is among the greatest possible number of workers. So much has been said that many of us have had the impression that the principle was not only generally accepted but widely adopted as well. Apparently this impression is far from the facts.

Within the last two weeks the president of an important company submitted as a brand new idea the principle of shortening the work week in order to provide employment for more men. If his case is typical, then many of the employers who should have been acting on this principle have either contented themselves with merely talking about it, or else have failed to grasp it at all.

For God's sake, let's get action! We are probably on the way out of this slough of despond, but the recovery is not going to be so rapid as to preclude the necessity for every possible device to find work for those who need it this winter.

Job Work on Production Lines

Executives of small shops dream of production lines and envy those whose output permits shop layouts where material flows in a steady stream. But even large shops have their troubles, especially when the output falls below the economical capacity of the equipment.

Compromises between the two systems are being made by some keen shop executives in medium sized plants. In one such plant visited recently, the shop has been laid out to handle a certain machine in lots of fifty. In addition to this machine, other parts must also be built from time to time, and the output is seldom sufficient to keep lots of fifty continuously under way.

The machine layout considers primarily the production line in its arrangement of millers, radials, multiple drills and other tools. It considers also the machining of various parts in much smaller lots and is so arranged that work closely akin to jobbing can be done on the tools in the production line.

While it is hardly likely that the layout of this particular shop would fit many others, the idea behind it can be adopted in other places to advantage. It has worked out well in this plant and would undoubtedly benefit many others.

How Much Labor Turnover?

No one questions the cost of excessive labor turnover. The loss of training and experience, which always represents an appreciable outlay, is frequently more than is realized. But there is also a distinct disadvantage in not having an influx of new ideas, of men who have gained their experience in other plants and have seen different solutions for the common problems of management or production. Plants that have prided themselves on very low turnover are finding themselves handicapped because of it, particularly where physical and mental disability among older men prevents them keeping pace with the increased speed of production lines.

As with most of our difficulties this is a problem for management. If an organization goes stale, management can hardly escape the responsibility of infusing it with new life, perhaps by instructors from the outside. The shop force should not be permitted to get into ruts but should be constantly inspired to find new and better methods.

Labor turnover, so far as it affects men of advanced years or physical disability, calls for the newer type of management, such as is evidenced by a number of industrial leaders. If older men

have served industry well in the past they can hardly be cast aside as we scrap machinery. Some concerns find it better in every way to retire men of this kind than to keep them in active service. In some cases they utilize their experience in consultation, but keep them out of the production line.

New blood and new ideas should always be flowing into a plant, into management as well as into the shop. And it is one of management's many duties to secure the needed turnover with fairness to all concerned.

◂◂ CHIPS ▸▸

No longer will the Government hire with one hand while it fires with the other . . . President Hoover instructs Federal Coordinating Service to set up clearing house for transferring employees . . . Navy League cuts loose with accusation that he is guilty of "abysmal ignorance" in Navy matters . . . The President creates a precedent by demanding an apology . . . National Credit Corporation's half billion dollar pool is fully pledged . . . Citroen shelves plan for world automobile cartel . . . blames Ford's refusal to show interest . . . Fact is other manufacturers were likewise lukewarm . . . Ford scales his minimum wage from seven to six dollars per day . . . salaries in proportion . . . Significant that Lamont, of Morgan & Company, blames import tariffs for this limping world . . . Protectionists, take notice . . . U. S. Steel votes regular one dollar dividend . . . Bethlehem, fifty cents . . . "Rust alone will keep steel production at present levels" . . . Gifford presents his ten point relief plan, and his company continues to lay men off . . . Railroad executives confer with the I.C.C. . . . The Supreme Court adjourns for lack of business, and no tears are reported . . . National Association of Manufacturers annual survey shows improvement in seven industries . . . includes automobile accessories, 14 per cent; electrical, 18 per cent . . . For week ending October 17, Department of Commerce reports advances too numerous to mention.

The world is still busy conversing about the Hoover-Laval conversations . . . Certain English newspapers seem suspicious . . . Laval expected to call cabinet meeting to approve France's calling an international reparations conference . . . Germany to ask reconsideration of reparations under Young Plan . . . U.S.S.R. cuts prices 30 per cent on food and clothing for the "bourgeoisie . . . Reports that the Soviets are concentrating troops on the Manchurian border are likely to prove untrue . . . internal troubles enough at home . . . will probably seek to avoid entanglements . . . China planning to spend eleven billion dollars on a ten year industrialization plan . . . will use private and government credit, not government ownership like Russia's . . . Winners in British elections begin to feel responsibilities . . . A protective tariff system in name as well as in fact almost assured . . . Germany and France are not the only countries dreading the move . . . British machinery trade shows distinct improvement . . . German trade sags with German credit.

A friend calls our attention to the following item in the New York *Times,* Sunday, October 11, 1931:

"The Advertising Department of the New York *Times* regrets the necessity for the omission of 16 columns of acceptable advertisements from today's issue."

If this be depression, give us all gas.

IN A LOS ANGELES OFFICE

You can't sell 'em
If you don't tell 'em.
You can't tell 'em.
If you don't see 'em.
See 'em!
Tell 'em!
Sell 'em!

Pratt & Whitney Aircraft and United Aircraft have representatives in China angling for orders . . . Metropolitan Body Company, Bridgeport, has already received enough orders for special mail truck bodies to keep production going for nine months . . . Chicago Great Western R.R. declares first dividend since 1919 . . . Holland Furnace Company reports heavy sales . . . McGill Manufacturing, Valparaiso, Ind., increases force to handle 500,000 dollar transmission bearing order from Chrysler . . . Chrysler, by the way increased net profits 51 per cent on previously reported sales . . . Pittsburgh steel operations up three to ten per cent . . . Steel sentiment better generally . . . Good to excellent increases in net profits for third quarter shown by Bohn Aluminum & Bronze, Crosley Radio, International Business Machines, Mullins Manufacturing, Perfect Circle . . . Westing-

house Electric & Mfg. will build refrigerator cabinets at Mansfield, O., after the turn of the year . . . Bradstreet's report shows largest number of increased commodity prices of any week this year . . . Franklin, Graham-Paige and Willys-Overland all report good sales increases . . . September washing machine sales top 1929 by two per cent, and 1930 by nine.

> J. C. Belden Manufacturing Company got this from an employee and said "Wow!"
>
> From a common laborer's view point, in order for prosperity to return I would suggest that all business—big and little—employ labor at what each business will stand, and gradually increase the wages as fast as prosperity returns, so we may be able to live. You financial wizards that assume to know it all, will you ever learn that you cannot defy and annul the natural law of supply and demand? Attempts have been made to peg or maintain an artificial price for rubber, sugar, wheat, copper and many other commodities—and with what result? Now you are trying to maintain an artificial price for labor, and in doing so you are obstructing the return of prosperity.
>
> —COMMERCE

THIS WEEK IN *AM*

If memory can be relied upon, the first inklings of what was going on at Electromatic Typewriters, Inc., Rochester, N. Y., came to us in 1930, and one editor visited the plant shortly thereafter. Somehow the time did not seem ripe for a story. This summer another editor made a special trip and secured the active cooperation of J. L. Petz, tool and production engineer. "Tool Economy Through Adjustability," the leading article in this issue, is the result. The editors wish to take this opportunity to acknowledge their indebtedness to him.

The Foreman's Round Table (page 694) takes up the universal problem of free speech. Whether you side with Al or Ed, other Round Table fans will be glad to read your opinions.

Last week it was stated that "Standardization by Preferred Numbers" (page 697) is one of those rare articles which takes a somewhat abstract subject and makes it practical. Now that you have read it and agree, you will be interested in knowing that Messrs. Hellmund and Hommel, the authors, are both with Westinghouse Electric & Mfg. Company. The former is chief electrical engineer and the latter an engineer in the standards division.

Tom White, author of "The Handicap of Age," makes his headquarters in Bridgeport, one of America's best known centers for fine machine and die work. His work has ranged from Victrola mechanisms at Victor to big guns at Bethlehem. The kind of experience he recommends is virtually impossible in youngsters.

When one man looked over the schedule for November 5, he remarked that it looked like a Shaw number with both Francis W. Shaw and Harry Shaw represented. But each has his contribution to make, each presents material that you can put right to work, and each is an old friend. "Experiences with Vibration" (page 693) and "Worm Gear Generation" (page 701) are worth every bit of time you can give them. W. H. Shipman, author of "Guaranteed X-Ray Inspection" (page 708), is special products engineer for The Babcock & Wilcox Company. His former connection with *American Machinist* both as an editor and as a research man will be remembered by many.

• COMING •

Even a sworn promise to secrecy is hard to keep, and we shall be almost as relieved as you when the winners of the *American Machinist* Awards for 1931 are announced. With the winning briefs themselves will be published the statements of the distinguished members of the Committee on Awards. The issue of November 12, will open the eyes of many an executive who thinks that a sound equipment replacement policy is beyond the reach of his plant.

Since there is always a possibility that we may talk too freely and too much, let us turn our attention to the issue scheduled for the week following. One article will show how standard times and incentives have been applied successfully to die making. So many men have labored under the sincere conviction that such a thing could never be done, the author seems to take a very human delight in showing them up. Another article will discuss modified gravity curves for quick acting cams. Still another will show the way to cashing in on the new alloys.

Looking still further ahead, we wish to announce that we have persuaded an experienced American toolmaker and tool room executive to write his honest impressions of Soviet Russia. He has just returned to the States, and what he has to say will round out the outstanding contributions already published in *American Machinist*.

THE . INDUSTRY .

Progress in Metal-Working and Machinery Markets

MACHINE TOOL markets still look forward hopefully to a general business upturn as a prelude to improvement in tool sales . . . Present tool purchases are of the same class as those of the past year—single tools for replacement, going to a wide variety of small buyers, after weeks of follow-up and haggling . . . Buffalo sees a definite upward trend, Detroit is decidedly optimistic, other districts have little, if anything, very encouraging to report . . . Used tools remain hard to sell at sacrifice prices.

NEW YORK reports isolated cases of improvement in inquiries and a little more optimism on the part of prospects, readvertising of two lathes for Brooklyn Navy Yard, and awarding of an 8-ft. radial drill . . . Philadelphia, with one optimistic exception, feels rather blue . . . Chicago hears of railway needs for tools, but present business precludes any purchases . . . Buffalo has sold $20,000 worth of tools to the fire department, and has a number of nice inquiries—if they can be turned into orders . . . New England had a quiet October, with foreign demand disappointing, though spotty industrial improvement is beginning, notably for valves, auto bodies, and aircraft.

DETROIT at last has increases in tool inquiries from automotive plants, although one buyer who took a dozen $2 saws last week insisted that they be delivered at a rate of two a week . . . Contract shops there are buying a little . . . Milwaukee has postponed its anticipations to the first of the year, although inquiries and scattered orders are coming from automotive, electrical, manufactured goods, government, and school sources . . . One manufacturer there had an October up 50 per cent . . . Cincinnati has a War Department order, some inquiries, but few other orders.

NEW YORK

Nothing exciting occurred last week, either in orders or inquiries. In isolated cases inquiries are bettering, and prospects are a little more optimistic as a result of betterment of commodity markets and other indications of general improvement. Final orders for the Subway list will be released in four or five days. Brooklyn Navy Yard is readvertising the two 24-in. by 16-ft. lathes remaining from the list recently closed. Fosdick got the 8-ft. radial drill awarded recently by the Navy Yard.

PHILADELPHIA

No change was noted during the last two weeks. Little business is stirring, and virtually no inquiries. No estimate on how soon a revival may be expected was hazarded. One larger agency reported a number of prospective sales in the offing, but how soon they will materialize into orders was not known.

CHICAGO

Practically no change is noted. Reports tell of continued depression, with about the average number of inquiries and an occasional sale. From a representative of a plant specializing in railroad shop equipment it was learned that some of the western railroads are confronted with the desirability of replacing tools showing indications of obsolescence, but that the present unsatisfactory status of railroad business will not permit of an outlay for new equipment, at least during this year. Industrial demand shows no improvement, nor is any looked for in the near future, except by extreme optimists. Inquiry for used tools is limited to absolute necessities, with lowest prices the main factor in the consideration of bids. The general opinion expressed is that not until the advent of 1932, if then, will there be any upward turn that will be worth getting excited about.

BUFFALO

The trend of business is definitely upward. Some orders have been placed by the City of Buffalo for machine shop equipment for the Buffalo Fire Department. These orders ran to nearly $20,000 and included a 24-in. lathe and two smaller ones, 15 and 9 in., as well as a milling machine, a pipe machine, several drill presses, a tempering furnace, and several other items.

Inquiries have improved considerably and occasional orders are now being placed as the result of inquiries made several weeks and even months ago. It seems that the total number of quotations made on material which is actually needed has reached really surprising proportions and if orders result from even a portion of them during the next few months there will be really good business.

NEW ENGLAND

October closed quietly. Foreign orders have not materialized, and centers which have shared a large volume of this business in the past are not hopeful of immediate placements from this source. The current week was extremely placid, with orders small and scattered. Industrially, spotty improvement was noted. A Massachusetts valve company reports small but sustained gains. A good order for automobile bodies was placed in Connecticut. The aircraft industry is fairly active with good prospects in view.

DETROIT

A somewhat better feeling pervades the machine tool field here as inquiries from automobile plants begin to increase. Within the last fortnight many manufacturers have asked for estimates on tools and equipment. Some inquiries and a few small orders have come from contract jobbing shops.

Thus far, however, improvement is merely in the atmosphere. All factories still keep a rigid watch on expenditures. They buy absolutely nothing they do not need at once. One large manufacturer placed an order for a dozen small $2 saws last week and insisted they be delivered at the rate of two a week.

There seems to be little doubt that automobile production will improve during November and December but no one knows whether the increase will affect the machinery trade.

MILWAUKEE

With business failing to gain the anticipated impetus, factors in the machinery and machine tool market now expect the first quarter of next year to bring about the long delayed improvement. Opinions are based on inquiries and small scattered orders coming from practically all sources with the exception of agricultural manufacturers and railroads. Industries showing favorable signs include automotive, electrical, manufactured goods, government aircraft and cruiser plans, and schools, the latter being the backbone of buying during recent months. One local manufacturer reports October business 50 per cent better than September.

CINCINNATI

Business momentum has not increased with manufacturers or selling agents. A small order came from the War Department. Most other sales were to general machinists and miscellaneous users whose requirements were single tools for replacement. A fair volume of inquiries is coming to some, but it is rare that a reply brings an order. Business booked is well scattered and diversified.

WEEK . BY . WEEK

BUSINESS BAROMETER

Trends in General Business throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

Following their conferences a formal statement was issued by President Hoover and M. Laval. It did not say much, and from its reticence many have inferred that the colloquies held were less cordial than they might have been. The facts are not available, but it is known that the other nations of the world were listening in, and that they were on the alert to catch anything that might be said about them. It seems to have been a case in which "the least said the soonest mended."

There is no denying that the uncertainty and doubt which previously prevailed has been somewhat increased as a result of the week's happenings, but it is equally certain that those who represent the United States at the various conferences now being held or arranged for have an exceedingly difficult, if not an almost impossible job ahead of them.

Britain Swings Back

It has, however, been somewhat simplified by the victory of the National Ministry and the Conservative party in Great Britain. On this side of the Atlantic this victory is regarded as presaging a return to the capitalistic basis from which Great Britain had been slightly swerved by her adventures in the field of Socialism. The elections of last Tuesday indicate that no further efforts in this direction will be made, and there is a confident feeling that with a strong government the English Exchequer ought soon to be in a stronger position. Some doubt has been expressed as to whether Premier MacDonald can hold together a coalition in which the Conservative strength is so overwhelming.

This is about all that one feels at liberty to say with regard to conditions abroad. There are many rumors and much gossip in circulation, but even those who lead in the political field of Europe seem to be in disagreement with most of their prominent contemporaries. Therefore, it is dangerous to give currency to reports of which one cannot be certain. In such conditions the safest rule to follow is to use the sixth sense, generally called common sense, and proceed to follow the course that we would have taken if our friends, neighbors and political associates had not persuaded us that there were ferocious lions in the way.

A Nervous Week

In "the States" as well as in Canada the week has also been a nervous one. In the United States more small banks have failed, and the number of such failures within the year is somewhat disturbing. The banks that have suspended are those that have been kept going during the past twelve or eighteen months in the hope of thawing out their frozen assets. Some of them have been successful in doing this, but others are being let go by the clearing houses and larger banks that have befriended them for so long. Perhaps it is just as well that the situation should be cleared up once and for all. Certainly the bankers of the United States should join hands in erecting a monument to the men who invented the phrase "frozen assets." By using it in their appeals for help many banks that might otherwise have been abandoned are now once again on a solid basis.

Be this as it may, there is much to indicate an improving tendency in American business. Taken as a whole, the commodity markets are somewhat higher, rubber being the only staple that shows much real decline, and the tire manufacturers are said to be buying in anticipation of their requirements.

A slight improvement in steel and iron is also reported. Cotton has eased off a little, but grains have had quite a sharp advance. On the Stock Exchange and in the bond market a good many securities that were hitherto regarded as gilt edged have been sold by investors who seemed to be alarmed at the international situation and the unwillingness of the Interstate Commerce Commission to allow the advance in railway freight rates that the railroads applied for. The situation so created is not reassuring, but the railroads of the country have been through vicissitudes that were much more trying. In 1894 the common stock of the Union Pacific, the Atchison, Topeka & Santa Fe, and several other important railroads could have been bought at under 10 per cent of their par value on the New York Stock Exchange. The prices to which they have since risen are examples of what can happen to railroad securities in this country.

Inflation continues to be widely discussed and there are many who claim that it is inevitable. The conservative opinion is, however, much opposed to any effort to fix prices artificially or by government edict. With France and the United States on a gold basis, and Great Britain anxious to re-establish the value of sterling, it is unlikely that we shall see any very radical change in the monetary situation for the next few months.

Speaking generally, and inclusively, the outlook is not clear, but the barometer furnished by commodity prices and quotations for investment securities would indicate that the mercury in the tube is about as low as it ever goes.

Copyrighted
Theodore H. Price Publishing Corporation
95 Broad St., New York

THE BUSINESS WEEK

November 4, 1931

Broad measures of general business volume are being distorted by abnormal banking conditions and by the steady narrowing down of trade to local activity which is not included in the national indicators . . . The decline in check payments, which brings our index to a new low level this week, reflects in large part the return of business to a cash currency basis in many localities . . . The slackness in carloadings likewise is a symptom of the increased relative importance, in such periods, of short-haul, quick-shipments, small order trade which shifts traffic to trucks and may be intensified by rate increases . . . The consumer necessity industries, catering to immediate short-range requirements, continue encouragingly active, but the big basic construction and equipment industries still show no sign of stimulation by obsolescence or investment expansion, and probably none is to be expected in the next two months . . . Wheat, cotton and a few other commodities have reacted strongly from bottom price levels as the speculative possibilities on the short side have become exhausted, foreign demand improved and the expectation of an inflationary session of Congress is discounted in advance . . . The securities markets have so far been able to extract little nourishment from the Hoover-Laval conversations and the British elections and need further injections of encouraging news or official action to emerge from the soggy swamp of slow liquidation in which they linger . . . These events, however, are of long-range importance as they indicate a decisive turn toward intensified national effort and individual initiative in Europe, which should give the cue to policy in this country.

© The Business Week

Material Trends and Prices . . . .

Demand for building, automotive and railway steel is such that 7,000 men will return to work in Pennsylvania plants during November. The market as a whole, however, is one in which gains realized in one material are immediately offset by losses in another. Moreover, activity is not evenly distributed among the producing centers. Buying interest is observed in the lead and tin markets but appears to be lacking in copper, zinc and other non-ferrous metals.

(All prices as of Oct. 30, 1931)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00@$12.00	$12.00	$14.00
Buffalo, No. 2, Fdry., per gross ton	17.00	17.00	15.45
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	10.00	10.50	13.00
Furnace Coke — Connellsville, per net ton	2.40	2.40	2.60
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.50
Steel Shapes — Pittsburgh, base, per 100 lb	1.60	1.60	1.60

•

Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb.:

Chicago....4.62½ Cleveland....4.50 New York....4.75
Cincinnati....4.35 Detroit....4.00

•

Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Blue annealed, No. 10	1.85	3.20	3.00	3.40
Black sheets, No. 24	2.40	3.55	3.60	3.50
Galvanized, No. 24	2.90	4.10	4.00	4.00

•

Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
		⅛	¼	¾	½	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

•

Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.90	3.60	3.60
Cold fin., round or hexagon	3.40	3.10	3.10
Cold rolled strips	4.95	6.00	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.65	3.50
Rivets	4.00	4.00	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

•

Stainless Steel — Hot-rolled bars, base, Pittsburgh. 0.12 per cent carbon, cents per lb.:

Chromium 15% and under....19.00 Chromium 18 to 23%....23.00
Chromium 15 to 18%....20.50 Chromium 23 to 30%....28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots....73–10%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:

Aluminum ingots 99%, N. Y	23.30
Copper, electrolytic, Conn	7.00
Copper wire, base, Chicago and Cleveland	9.37½
Copper wire, base, N. Y.	9.25
Lead, pigs, E. St. Louis	3.80
Tin, Straits, pigs, spot, N. Y.	22.87½
Zinc, slabs, E. St. Louis	3.22½

Prices following are in cents per lb., base, N Y., Chi. and Cleve.:

Brass rods, high	11.25
Brass sheets, high	13.00
Brass tubing, high	16.25
Copper, drawn round	13.62½
Copper sheets	16.12½
Copper tubing	15.62½

Prices following are in cents per lb., del. from N. Y. warehouse:

Babbitt, anti-friction, general service	28.75
Babbitt, com'l, intermediate grade	34.50
Babbitt, genuine, highest grade	43.50
Solder, bar	17.87½

Prices following are in cents per lb., base, Huntington, W. Va.:

Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

•

Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.50	2.50	2.25
Light brass	2.00	1.75	2.00
No. 1 rod-brass turnings	3.00	2.75	2.50
Heavy copper	5.00	4.25	4.00
Light copper	4.00	3.75	3.50

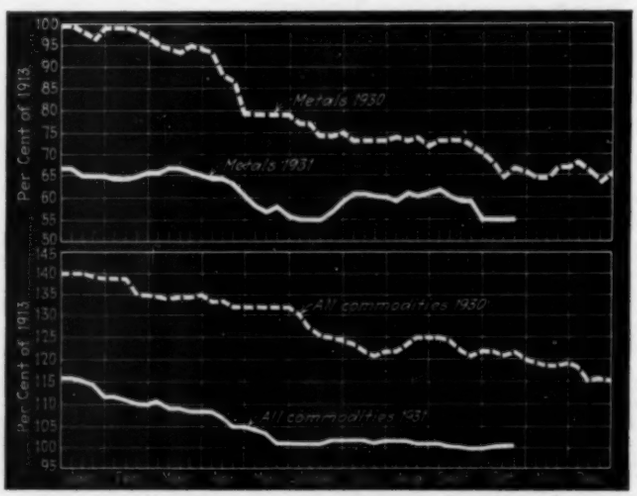
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	30–10%	40%	40%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60%

Lumber — Per M ft., b.m., 12-16 ft. lengths, delivered, N. Y.:

Crating — Southern pine:
1x4-in.... $27.00 1x6-in.... $26.00

Skids—Spruce:
2x4-in.. $37.00 3x4-in..$40.00 4x6-in..$42.00 6x6-in ..$50.00



Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

NEWS

Standardization of Machine Finishes

The A.S.M.E., through action of its council has requested the American Standards Association to authorize the organization of a sectional committee to undertake the standardization of finishes on machine surfaces. The recommendation was prompted by the interest of engineers and production men in the presentation of a paper by R. E. W. HARRISON at the December, 1930, A.S.M.E. annual meeting entitled "A Survey of Surface Quality Standards and Tolerance Costs based on 1929-1930 Precision-Grinding Practice." A phase of this proposed project was also developed by a recent paper by R. C. DEALE on "Standardization of Machining Finishes."

Pres. Hoover Receives Automotive Engineers

President Hoover received the members of the Society of Automotive Engineers attending the Ninth National Transportation Conference at noon, Oct. 28. Several hundred transportation experts and automotive engineers were in attendance at the three-day traffic meeting called by the Society for the purpose of considering all phases of motor buses and motor truck operation; automotive vehicle and highway coordination, legislation, Diesel and gasoline engine design and operation, chassis lubrication, the equipment and operation of fleet repair shops and other economic matters of interest to operators and owners. The technical program appears in *American Machinist,* p. 652l, Vol. 75.

$11,000,000,000 for Machinery in China

A ten-year industrialization plan, calling for the expenditure of $11,000,000,000 for machinery construction alone, is being considered by the Chinese Government. A report to the Department of Commerce said the plan called for the use of Government and private credit instead of Government ownership as in the case of Russia.

The first step in the proposal would be establishment at Nanking of a school headed by expert foreigners to train an army of highly skilled Chinese mechanics to construct machinery and install it in Government factories. The plan embraces the development of harbors, canals, railways and roads, the opening of the vast undeveloped area of northwest China and the setting up of agricultural and pastoral industries throughout the republic.

German Machine Building Shows Drop in August

Domestic inquiries and orders in the German machine building industry showed a further decline during August, according to a report received by the Department of Commerce from its Berlin office. Foreign customers also held back more strongly on inquiries and orders than they had in July. Trade was completely under the influence of the financial and credit crisis in Germany. The difficulties in obtaining credits and the high interests caused postponements in the investment funds in plants.

The average weekly working time dropped from 42.2 to 42 hours. The degree of occupation fell from 42.8 per cent in July to 42.1 per cent of capacity in August. As in many cases, the curtailments of operations have already reached the utmost possible limit. A further increase in the number of shutdown plants is to be expected.

British Machinery Trade Shows Improvement

Somewhat more encouraging conditions are noticeable in various branches of the British machinery industry, according to a report of the Department of Commerce. Machine tool manufacturers are now well employed compared with recent months, and the demand for internal-combustion engines, air compressors, and several lines of auxiliary machinery is well maintained. In the Birmingham district, during the last two weeks, the heavy industries have shown distinct signs of improvement. A slightly better tone is reported to prevail in the engineering section of the Sheffield district, with orders for axles, steel rails, coal crushing and screening plants, tools and forging hammers being received from both home and abroad. It is further reported that a comparatively large amount of business is being received from abroad by textile machinery manufacturers.

Alford Wins Gantt Medal

LEON P. ALFORD, chairman of the Ronald Press, New York City, consulting editor of *Factory & Industrial Management,* and formerly editor of *American Machinist,* received the Henry Laurence Gantt Memorial Medal for 1931 at a dinner Oct. 29. The medal was awarded to Mr. Alford for "his contribution to the formulation of methods of measurement and the principles, laws and practices of industrial management." Several speakers mentioned in particular the influence exerted by Mr. Alford's writings while he was connected with *American Machinist.* The list of speakers and their topics was presented in *AM* on page 652l, Vol. 75.

Recovery Has Begun, Trade Survey Shows

The lowest point of the industrial depression has been passed and recovery—slow in general, but quite active in many instances—has begun, according to the Annual Trade Survey of the National Association of Manufacturers, made public by J. Lewis Benton, general secretary of the association, at the thirty-sixth annual meeting, held at the Waldorf-Astoria Hotel.

Mayors, city managers, chairmen of regional and city employment stabilization councils and individual directors of plant programs—ten in all—described various proposals for unemployment relief at the second annual conference on methods of relieving and preventing unemployment, held in conjunction with the meeting.

The day was devoted to the problem of employment stabilization and relief, and the employment relations committee of the association made a comprehensive report with recommendations for standardizing unemployment emergency relief funds.

The Annual Trade Survey, which is a spot report of present conditions, covered 800 replies received up to Oct. 24 to a questionnaire sent out on Oct. 15 to more than a score of industries ranging from automobiles to textiles. A summary of the general averages of the replies shows the following: "Present trade was reported fair to excellent by 48 per cent, and poor by 52 per cent. Prospects for the Winter were considered fair, good or excellent by 58 per cent and poor by 42 per cent."

France Envies Her Industrial Neighbors As Foreign Trade Continues Decline

By Our Paris Correspondent

The French industrial indexes register a fall in prices of raw and intermediate materials in the metal trades. Further, economic depression is growing more pronounced. Foundries have begun to feel the effects of instability and are seeking business on a price basis in order to keep their plants operating in some adequate proportion of capacity. German prestation deliveries of foundry output on reparations account were but 151 tons in the first six months of the present year, another indication that the French interior market is decidedly slack.

French foreign trade is still declining. Imports from foreign countries fell off over 4 billion francs during the first seven months of the year; exports nearly six and a half billion. What is more significant, since they include a large proportion of production goods (machinery and manufactures), is that exports to the colonies and protectorates dropped off more than a billion francs.

Imports from the United States fell 500 million francs in value, from Great Britain nearly a billion and a quarter and from Germany nearly three quarters of a billion. Imports from Soviet Russia more nearly held up than any others, but the value of exports to that country fell from 131,186,000 francs to 32,336,000 francs.

Franco-Sovietic negotiations for a more liberal régime of commercial exchanges are now being carried out. Senator Gaston Japy, well-known in the transforming metal industry, has protested that already American engineering participation in Soviet industry has prepared the way for an overflow of Soviet machine-made products into the French market. Along with Senator Japy's remonstrance against American ideas, he still finds room to include a like criticism of German, Italian, Swedish and English technicians who have also exported their skill to the land of the Soviets. His final admonition is to the effect that the citizens of these "naïve civilized governments," by aiding Russia, are but digging their own commercial graves.

In spite of this France received Soviet orders in a single month this year, for machinery, electrical goods and non-ferrous metals, for the equivalent of $900,000. French business had been falling off, while that of Germany and Italy had been steadily increasing. Italy alone has recently announced Soviet orders in hand to the extent of $32,000,000, while orders placed in Germany in 1930 exceeded $140,000,000.

France looks askance also at England. She feels that she has saved Britain financially and now with the extreme probability of a general tariff, and the possibility of forbidding the entry of luxury goods at all, France considers that, alone of all nations, she is especially singled out for martyrdom. During the last three years Great Britain bought French machinery (including automobiles) to the bulk of 113,678 metric tons, while France imported 94,499 tons of like goods from England. What part of this may be considered as luxury goods is not defined, but if even a minimum tariff is imposed the 20 per cent variation against France is considered quite enough of an item to warrant a protest.

The Metallurgical Syndicates Federation has come forward with a hardy, but not very hospitable, suggestion that all imports, of whatever nature and whatever their source of origin, within its classification, be based on a contingent, elastically expanded or restricted from month to month. If contingents are exceeded, a super tax of 10 per cent automatically comes into force.

In the three years ending Dec. 31, 1931, world export trade of France in manufactures of iron and steel fell 23.8 per cent in value and 36.5 per cent in bulk. The value imported of like goods in the same period increased 36.6 per cent.

The attitude amongst many French economists appears still to be that machinery and its output is racketeering French tradition out of business, and, in spite of Leon Jouhoux and his disciples of the General Workers Confederation, thousands of mechanics seem to hold the same view.

In the latter case the fear is that there will not be enough work to go around. They claim that there is no joy in mass production methods of putting a round peg in a round hole, whereas there would always be profit for all if pegs were square and still had to be fashioned before they would fit round holes. The simile seems just, considering French temperament.

There is no doubt but that the transforming industries in France, with minerals and metals for their base, expanded too quickly for their still embryonic distribution facilities. The Economic Committee of the League of Nations points this out in a comparative production table which gives an index number for France of 522 (100 — 1913) as compared with Great Britain, 115.

Prices of raw materials in the metal trades are given by the same authority, compared with 100 for 1913, as 116 for Germany and 540 for France. Reduced to gold values the French index would come down to approximately 108. It is thus apparent that any lower prices quoted in world markets for German goods are based on lower production costs, including those of manipulation and overhead. Again the authority quoted states that France has been as little affected as it has because of its minor rôle in foreign trade.

On the basis of 1929 (100) general production, France for the first quarter of 1931 had an index of 95 and for the second quarter, 92. Germany meanwhile had fallen to 68, to rise in the second period to 73. The indices for Great Britain are respectively 77 and 73. The figures are those of the League of Nations Committee, brought into being for the study of the world economic depression, and are results of submissions by nineteen research institutions located throughout the world.

A.M.A. Announces Shop Methods Conference

The second meeting of the Shop Methods Division, American Management Association, will be held at Dayton, Ohio, Jan. 21 and 22, 1932. Topics on the program are: "Production Planning and Control for the Mass Production Plant," by a group under the direction of R. F. Whisler, head, Standards Department, National Cash Register Co. During the afternoon there will be visits to several plants in Dayton. At the dinner that evening, G. M. Fullarton, assistant superintendent of manufacturing planning, Hawthorne Works, Western Electric Co., will present a paper on "Translating the Long Range Plans into a Shop Program." The other paper for presentation and discussion will be "The Contributions of the Shop Methods Man to Long Term Planning," by T. G. Graham, vice-president, the Goodrich Co.

Friday morning's program on "Production Planning and Control for the Job Order Plant" will be organized by members of the Industrial Management Council, Rochester Chamber of Commerce. The Friday afternoon program on "Production Planning and Control for the Modified Mass Production Plant" will be presented by a group under the direction of Charles S. Craigmile, superintendent, Belden Mfg. Co., and other representatives of Chicago members.

The annual convention of the Personnel Division of the A.M.A. will be held at the William Penn Hotel, Pittsburgh, Pa., Feb. 16 and 17, 1932.

Auto Shows In January

Forty-three makes of passenger cars, trucks and taxicabs will be exhibited at the 1932 National Automobile Shows, to be held in New York Jan. 9-16 and in Chicago Jan. 30 to Feb. 6. The New York Show will be in the Grand Central Palace, and the Chicago Show in the Coliseum.

Auto Output Falls During September

Production of automobiles throughout the United States in September, based on actual sales at factories, totaled 140,566 cars, the smallest month's output in recent years, with the exception of November, 1930, when the total was 136,754 vehicles. The total included 109,087 automobiles, 31,338 trucks and 141 taxicabs. The output for September showed a decline of 46,631 vehicles below August and was 80,083 under the same month last year.

Technical Program For Acetylene Meeting

A comprehensive discussion of methods for testing oxy-acetylene welded joints will be one feature of the thirty-second annual convention of the International Acetylene Association at the Congress Hotel, Chicago, Nov. 11-13.

At the weld-test session the evening of Nov. 11, PROF. H. L. WHITTEMORE of the U. S. Bureau of Standards will speak on the importance of tests to welders and to users and makers of welded products. There will be a dramatized demonstration of visual and stethoscopic tests; hammer, bending, tension and hardness tests; invisible-ray tests; specific gravity, compression, and internal pressure tests. At this session, a weld-strength estimating contest of three welds will be held. The five estimates closest to the figures revealed on tensile test will win prizes. Among other talks at this session will be "Today's Opportunities for Welding-Trained Men in the Metal-Working Trades and Industries," by DR. S. LEWIS LAND, educational director of the Heating and Piping Contractors' National Association; and "Training Gas Welders for the Job," by THOMAS JONES, superintendent of welding for the Illinois Steel Co.

PROF. COMFORT A. ADAMS of Harvard, and G. O. CARTER, consulting engineer, will discuss the welding situation in general at the Nov. 11 afternoon session.

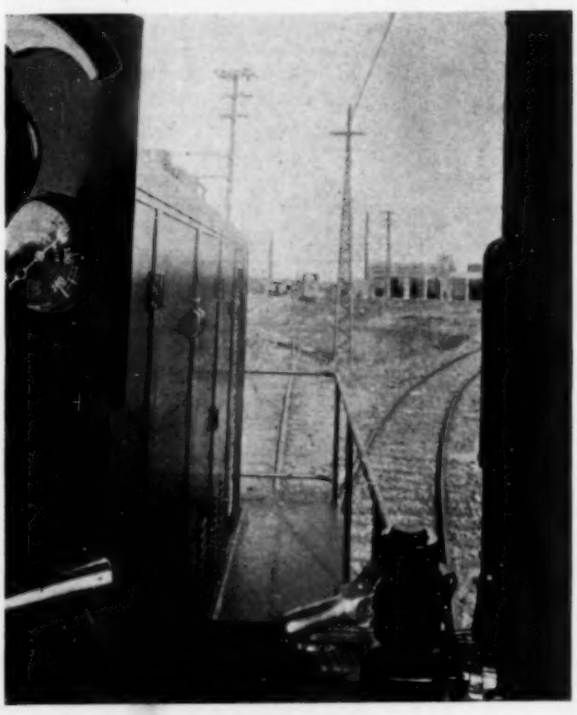
The use of the oxy-acetylene process in transportation industries will be treated the morning of the following day, including welding on the U. S. airship "Akron," scrapping railroad cars by the production line method with the oxy-acetylene blowpipe, and "Present Practices in Rail Bonding."

That afternoon authorities on welded piping will discuss welded heating, water, and air-conditioning systems; overland oil and gas lines; and the use of special fittings for welded installations.

The afternoon meeting will treat engineering education in welding, with W. H. MAGER of the General Motors Institute of Technology, speaking on this topic. PROF. S. C. HOLLISTER of Purdue University will discuss "What the Welding Industry Must Do to Receive Engineering Acceptance More Rapidly." At this session the Oxy-Acetylene Committee report, describing the year's progress in the use of welding, will be presented. Admission to any or all sessions of the convention is free.

Foote-Dodge Merger Abandoned

The proposed merger of the Foote Bros. Gear & Machine Co., 215 North Curtis St., Chicago, Ill., and the Dodge Mfg. Co., Mishawaka, Ind., announced some time ago, has been definitely abandoned, according to an announcement by J. F. GRISWOLD, president of Foote Bros. It is understood that both Foote Bros. Gear & Machine Co. and the Dodge Mfg. Co. will carry on their business as in the past, under their own separate corporate names and identities.



Maximum visibility is afforded the engineman in this first all-welded Diesel electric switching locomotive. One of seven 60-ton, 300-hp. units just completed by General Electric for Bush Terminal, New York City, the entire mechanical portion, including the modified steeple cab, underframe and trucks, is fabricated of arc-welded steel plate and standard shapes. Two control stations are diagonally opposed in the cab, this one opening out on the long hood that covers the 325-bhp. Ingersoll-Rand engine and part of the generator

Shipbuilding Dull; Lowest Since War

As the result of a further decline in shipbuilding, the tonnage of merchant vessels under construction in the principal maritime countries of the world is at a new post-war low level and is less than half the volume of construction under way just before the World War, according to the Department of Commerce. A decline of nearly 300,000 gross tons has occurred since June 30, 1931, and this followed a drop of about 175,000 tons in the quarter ended March 31. At this time last year over 1,000,000 gross tons more of shipping were being built than today. The greatest decline reported was for Great Britain and Ireland.

Freehand Sketching Offered by Wisconsin

To provide training in freehand industrial sketching, the University of Wisconsing Extension Division is offering a new course of that name, by LAWRENCE E. BLAIR, Instructor in Drawing. This course of 16 assignments, taught by the home-study method for students anywhere, introduces the necessary procedure for making sketches to be used in conferences with executives, designers, inventors, and draftsmen. The instruction may also be applied in the sketching of parts needed for repairs, improvements, additions, or changes in equipment or structures, or for laboratory records. The course assumes that the student is familiar with the proper placing of views, the making of sectional views, and the use of symbols and conventions. Inquiries are answered by the University Extension Division at Madison.

Federal Specifications

Federal Specification QQ-B-621 for commercial and naval brass castings is being suggested as a proposed revision of Federal Specification No. 272. Also Federal Specification QQ-M-71 on Manganese Ore is suggested as a revision of Federal Specification No. 142. Federal Specification QQ-B-691 for Bronze Castings is suggested as a revision of No. 172a, and QQ-F-151 on Ferrochrome is suggested as a revision of No. 139.

BUSINESS ITEMS

Tips, Inc., 515 Cathedral St., Baltimore, Md., has been incorporated under the laws of the State of Maryland to distribute standardized cutting and welding tips, apparatus and accessories and other merchandise of a similar nature. Officers include: OTTO W. DIEFFENBACH, president; GEORGE M. ENGLAR, treasurer; EMORY H. NILES, secretary and L. D. GANS, assistant secretary. Mr. Dieffenbach was formerly secretary of the Black & Decker Mfg. Co., Towson, Md., and manager of the Baltimore plant. The company has an authorized capital of 500 $100 par value shares and 1,000 shares of common stock of no par value. It has placed a contract for tips and apparatus with the Alexander Milburn Co.,

The Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa., is making an extensive test of paints for the inside of water tanks in a one million gallon water tank at Ambridge, Pa. The inside of the tank shell and bottom has been divided into 196 vertical strips, each strip being painted with a different compound or coating material, including all the usual paints, asphalt paints, coal tar paints, aluminum and other metallic paints, paints made of bakelite, rubber and other special materials, enamels applied hot nd many new and unusual paint materials. The tank will be filled with water and placed in service and then emptied at periodic intervals for inspection. Reports will be issued periodically.

The Marine Engineering Group, General Engineering Dept., of the Westinghouse Electric & Mfg. Co., has been merged with the Steam Engineering Department of the South Philadelphia Works. This group will remain at the East Pittsburgh, Pa., plant and will continue under the direction of H. C. COLEMAN, who has been appointed section engineer.

The American Manganese Steel Co., Inc., Chicago Heights, Ill., has moved its Chicago office from 333 North Michigan Ave., to Room 1414 McCormick Bldg., 332 South Michigan Ave., where the company is located with its parent company, American Brake Shoe & Foundry Co. E. F. MITCHELL and E. R. DOUGHERTY are sales representatives.

The Troy Laundry Machinery Co., East Moline, Ill., employing a normal force of 300, has made several additions to its staff to meet the production peak demand, according to G. E. SUMNER, factory manager. Receipt of an unusually large number of orders has resulted in the increase in production, expected to continue for some time.

The John W. Brown Mfg. Co., Columbus, Ohio, has transferred all its Columbus manufacturing activity to its Cincinnati factory. According to reports very little of the plant's machinery is being moved to Cincinnati, the factory there being fully equipped. Only about eight of the firm's executives and departmental heads and a very few of the present working force of 300 were transferred to Cincinnati in making the move.

Beginning Jan. 1, 1932, refrigerator cabinets will be manufactured in the Mansfield Works of the Westinghouse Electric & Mfg. Co. This will mean speeding up production of the plant to capacity operation for the entire year of 1932.

The Standard Iron Works, Ltd., and the Dominion Bridge Co., Ltd., have erected and equipped a new plant at Edmonton, Alberta, which is now in operation. Equipment has been installed to do general and heavy machine shop work. Property on which the new plant is located is approximately 5 acres in extent. The plant cost $200,000 to build and equip.

The Spring Perch Co., automobile spring manufacturer of Bridgeport, Conn., is building a new plant in Buffalo, to contain 100,000 sq.ft. of floor space. It will move upon compleiton of the new plant. JOHN C. HAWLEY is president and HAROLD T. Dow is chief engineer.

The Farmall tractor works of the International Harvester Co., Rock Island, Ill., went on a 4-day week basis Nov. 1 as a result of International's new production program. The Farmall unit has been on a 3-day week with a force of about 1,500 employees.

The Metropolitan Body Co., Bridgeport, Conn., has received a large order to furnish special mail truck bodies to the U. S. Post Office Department.

The Union Switch & Signal Co., Swissvale, Pa., and the General Railway Signal Co., New York City, have formed the Signal Export Association for exporting railway signal equipment and other apparatus. Offices are at 74 Trinity Place, New York City. Officers are GEORGE A. BLACKMORE and PAUL RENSHAW, managers; CHARLES M. MUCHNIC, secretary, and B. P. WAYNE, assistant secretary.

An agreement has been made between the Sprague Specialty Co., North Adams, Mass., and Electric Auto-Lite, Ltd., Sarnia, Ont., whereby the former company will establish a Canadian branch company in Sarnia. Electric Auto-Lite, Ltd., will own a substantial interest in the new company, whose products will be made in its plant.

The Chicago office of the Shepard Niles Crane & Hoist Corp., has been removed from the People's Gas Bldg., to 564 West Monroe St., Chicago. WALTER B. BRIGGS is district manager and G. G. ROBBINS is associated with him.

Chatard & Norris, 218 Water St., Baltimore, Md., have been appointed exclusive representatives of the Homestead Valve Mfg. Co., Inc., Coraopolis, Pa., for the eastern part of Maryland and the District of Columbia.

The Norge Corp., Detroit, Mich, subsidiary of the Borg-Warner Corp., Chicago, has acquired the Alaska Refrigerator Co., Muskegon, Mich., refrigerator builder for 50 years.

The new addition to the Cranbrook (B. C.) Foundry & Machine Shops, has been completed and is being used principally as a furnace room and casting department. It is a concrete block building, 40x50 ft., adjoining the present machine shops.

The Cascade Machinery & Electric Co., Seattle, Wash., has moved its offices and plant from 2726 First Ave. south to larger quarters at 63 Horton St. The firm handles lines of electrical, mining and hydraulic machinery.

The United Aircraft & Transportation Corp., and the Pratt & Whitney Aircraft Co., Hartford, Conn., have representatives in China to negotiate airplane orders. The Chinese army has an armored Sikorsky plane, Vought and Boeing planes, and Martin bombers.

Krischer's Mfg. Co., Brooklyn, N. Y., manufacturers of trunk hardware, buckles and other metal specialties, has leased the O. B. North Co. plant, New Haven, Conn., and plans to use the added facilities for expansion. The O. B. North Co. was acquired by the North & Judd Mfg. Co. last year.

Operations of the Zollner Machine Works will start soon at Fort Wayne, Ind., according to THEODORE ZOLLNER. The company has stopped operations at Duluth, Minn., and machinery and other equipment from Duluth has been shipped to Detroit. The Fort Wayne plant has been completed and many former employees will be transported to Fort Wayne.

The Wayne Pump Co., Fort Wayne, Ind., is moving its Rochester (Pa.) plant to Fort Wayne. The plant has been known as the Fry division and gives employment to approximately 500. It will begin operations in Fort Wayne about Dec. 1 in a new building.

Announcement has been made by the Westinghouse Lamp Co., and the Electrical Association of New York of the acquisition by the latter of the Westinghouse Lighting Institute in Grand Central Palace.

Aluminum Industries, Inc., has opened a new branch at 431 Peachtree St., Atlanta, from which the entire line of its products manufactured at Cincinnati and St. Cloud, Minn. will be marketed.

The Langsenkamp-Linkert Carburetor Co. has been formed in Indianapolis, Ind., and has begun production in the former plant of the Wheeler-Schebler Co., which several months ago was purchased by the Marvel Carburetor Co. and moved to Flint, Mich. Officials of the new company are: H. W. LINKERT, formerly chief engineer of Wheeler-Schebler, president; HENRY LANGSENKAMP, treasurer; S. R. HAWKINS, vice-president in charge of sales; A M. LANG, vice-president in

charge of manufacturing; and HENRY LANGSENKAMP, JR., secretary. The company is a division of the Langsenkamp-Wheeler Brass Works.

The Neille LaVielle Supply Co., 505 West Main St., Louisville, Ky., has been appointed local representative for the Foote Bros. Gear & Machine Co.'s line of IXL gears and speed reducers.

PERSONALS

W. C. HEATH, vice-president of Fairbanks, Morse & Co., Beloit, Wis., in charge of manufacturing, resigned Nov. 1 to join the A. O. Smith Corp., Milwaukee, in an executive capacity. Mr. Heath has been with the Beloit concern since 1909, when he joined the engineering staff. Since 1927 he had been in charge of all manufacturing operations in the company's factories in Beloit, Three Rivers, Mich., and Indianapolis, recently consolidated in Beloit. A. W. THOMPSON, associated with Fairbanks, Morse & Co., in an executive capacity since 1920, has been appointed successor to Mr. Heath. Previous to coming to Beloit, Mr. Thompson was for 10 years with General Electric.

WILLIS C. BROWN, director of sales and service for the Continental Aircraft Engine Co., Detroit, has resigned to organize the Willis C. Brown Co., Tulsa, Okla., for the sale of Continental industrial engines and certain electrical and mechanical specialties for the oil fields.

HARLOW D. BURNSIDE, formerly factory manager of the Clark Tructractor Co., Battle Creek, Mich., plant, has taken charge of the manufacturing program of the Universal Cooler Corp., Detroit.

WALTER S. FRANKLIN, assistant to the vice-president of operation of the Pennsylvania Railroad, has been elected president of the Wabash Railroad to succeed the late WILLIAM H. WILLIAMS. Mr. Franklin also was appointed president and a director of the Ann Arbor, a subsidiary of the Wabash. The appointment is subject to approval by the Interstate Commerce Commission, and the decision of that body will indicate whether the commission believes the Pennsylvania Railroad may strengthen its hold of the Wabash at this time. WINSLOW S. PIERCE, general counsel of the Wabash, has been made acting chairman, and S. E. COTTER, vice-president, has been placed in charge of operations at St. Louis, where his offices have been for some time. Mr. Franklin will have offices in New York.

CHARLES J. P. HOEHN of the Enterprise Foundry Co., San Francisco, Calif., has been elected president of the Pacific Coast Founders Ass'n.

RALPH LEAVENWORTH has been appointed general advertising manager of the Westinghouse Electric & Mfg. Co., according to an announcement by J. S. TRITLE, vice-president and general manager. He will have charge of all advertising and publicity activities, including the advertising division of the merchandising department.

HARRY H. HANNUM, formerly with the Hannum Mfg. Co., and its predecessor, the Lavine Gear Co., Milwaukee, has been named purchasing agent of the Heintz Mfg. Co., Philadelphia, manufacturer of steel auto bodies and parts.

A. J. KOHN, president of the Schauer Machine Co., 905 Broadway, Cincinnati, Ohio, has been appointed receiver of that company.

GORDON LEFEBVRE, formerly vice-president in charge of operations of Oakland Motor Car Co., Detroit, will head a recently organized engineering firm, Gordon Lefebvre & Co., with offices at 422 Stormfeltz-Lovely Bldg., Detroit. HARRISON J. STRINGHAM, formerly vice-president of Wm. L. Davis & Co., Investment Bankers, will be associated with Mr. Lefebvre. The firm will act as consultants on production, cost, merchandising, building, machine design, and financing.

W. LAURENCE LEPAGE, formerly chief engineer, Kellett Aircraft Corp., Philadelphia, Pa., has been elected vice-president in charge of engineering.

G. S. MCKEE, superintendent of the refrigerator department of the Grigsby-Grunow Co., Chicago, Ill., and previous to that assistant superintendent of the Canton (Ohio) Timken plant, has resigned and will be located at 44 University Terrace, Athens, Ohio. JOHN DLESK, head of the Grigsby grinding department, also assumes the duties of general superintendent.

DANIEL SELTZER, president of the Ohio Cultivator Co., Bellevue, Ohio, was elected president of the National Association of Farm Equipment Manufacturers at the close of the 38th annual convention at the Congress Hotel, Chicago, Oct. 21-23. CHARLES DEERE WIMAN, president of Deere & Co., Moline, Ill., was elected chairman of the executive committee.

W. P. WITHEROW, vice-president of the Republic Steel Corp., Youngstown, Ohio, has resigned to devote his time to private interests. He was president of the Witherow Steel Corp. and chairman of the Donner Steel Co., and became vice-president of the Republic Steel Corp., after Donner was merged with Republic. He is also a director in many institutions, including the Steel Products Co., Spencer Mfg. Co., and Mid-West Forge Co.

OBITUARIES

WILLIAM K. BIXBY, 74, retired car builder and one time chairman of the board of the American Car & Foundry Co., died of a heart attack Oct. 29. President of the Missouri Car & Foundry Co. at 31, he effected the thirteen mergers which in 1899 formed A.C.F. with Mr. Bixby as president. He retired when 47.

LEE W. BARBER, 55, president of the Standard Car Truck Co., Chicago, Ill., died Oct. 18 at Monrovia, Calif. He had been with the company for 35 years, actively until a month ago.

JAMES CONNOLLY, vice-president of the Lovewell-Henrici Corp., Chelsea, Mass., died recently after a heart attack.

NATHANIEL CURRY, first president of the Canadian Car & Foundry Co., and later chairman of the board, died Oct. 23 at his summer home.

ELMER W. DEVED, assistant superintendent of production at the Yale & Towne Works, Stamford, Conn., and with the company for nearly 34 years, died suddenly Oct. 27 of a heart attack.

LINCOLN A. HALL, 66, formerly secretary and treasurer of the Lodge & Shipley Machine Tool Co., died unexpectedly of a heart attack Oct. 25 in Cincinnati. He had been retired for the last seven years.

MAURICE KANE, 83, former general manager of the experimental department, International Harvester Co., Chicago, Ill., died Oct. 17 there. He had retired several years ago.

RICHARD T. MARTER, 66, superintendent of the National Enameling & Stamping Co., and associated with the company in Milwaukee for the past 49 years, died Oct. 20.

COL. REUBEN MILLER, 69, former vice-president of the Crucible Steel Co., Pittsburgh, Pa., died Oct. 23 there. He had been connected with Crucible and its subsidiaries since graduation from college.

GEORGE J. MISCH, 51, superintendent of the Peerless Motor Car Corp., Cleveland, for 20 years until his retirement two years ago, died suddenly Oct. 27.

PHALLIP SCHWENN, 62, superintendent of the H. P. Deutcher Co., Hamilton, Ohio, died there recently.

George Edward Smith, 77, foreman of the blacksmith department of Layne & Bowler, Inc., Memphis, Tenn., died of a heart attack Oct. 25. A native of Birmingham, England, he came to America 50 years ago. He had been in charge of his department for 15 years.

CARL B. WOODWORTH, 47, western manager and railroad manager for the Vanadium Corp. of America, New York City, with headquarters at 310 South Michigan Ave., Chicago, died here Oct. 24 after a week's illness.

MEETINGS

AMERICAN MANAGEMENT ASSOCIATION
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Nov. 11-13 Headquarters, 20 Vesey St., New York.

INTERNATIONAL ACETYLENE ASSOCIATION
Thirty-second Annual Convention, Congress Hotel, Chicago, Nov. 11-13. Headquarters, 30 East 42nd St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice, secretary, 29 West 39th St., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
Annual meeting, Book-Cadillac Hotel, Detroit, Mich., Jan. 25-29. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Me., Bangor—A. E. Webber, c/o Webber Motor Co., 142 Exchange St., awarded contract for a 1 story, 90 x 175 ft. automobile sales and service station on Hammond St. Estimated cost $40,000. Noted October 22.

Md., Baltimore—Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded contract for a 2 story addition to engineering experiment building at Navy Yard here. $60,000.

Mass., Danvers—G. Stahler, 15 High St., Middletown, is receiving bids for the construction of a 1 story, 60 x 100 ft. garage and showroom on Maple St. here. Estimated cost $40,000. G. H. Fanning, 221 Essex St., Salem, Archt. Noted Oct. 22.

Mass., Everett (Boston P. O.)—Merrimac Chemical Co., c/o J. B. Ruffer, Chemical Lane, will soon award contract for H-acid plant. Estimated cost $40,000. Private plans.

Mass., Fall River—Firestone Tire & Rubber Co., 1278 South Main St., Akron, O., awarded contract for a 1 story addition to service station at Pleasant and Sixteenth Sts. here. Estimated cost $45,000. Noted Oct. 22.

Mass., Middleboro—Nemasket Transportation Co., West Grove St., awarded contract for the construction of a 1 story, 65 x 110 ft. garage on West Grove St. Estimated cost $40,000. Noted Oct. 22.

Mass., Quincy (Br. Boston)—Standard Oil Co. of New York, 26 Broadway, New York, N. Y., will receive bids about November 3 for the construction of a garage, office building, storage tanks, etc. at Town River here. H. K. Morse, Park Square Bldg., Boston, Engr. Noted July 2.

Mass., South Boston (Br. Boston)—Downer Kerosine Co., 116 West First St., awarded contract for rebuilding 2 story, 50 x 110 ft. foundry on West First St. here. Estimated cost $40,000.

Mass., Wareham—J. Jason, Main St., awarded contract for a 1 story, 55 x 115 ft. garage and salesroom on Marion Road. Estimated cost $40,000.

Mass., Watertown—Kimball Lumber Co., 148 Waltham St., awarded contract for a 1 story storage building on Waltham St. Estimated cost $40,000.

Mass., Wellesley—H. O'Shaughnessy, c/o J. J. O'Shaughnessy, 80 Boylston St., Boston Archt., plans under way for the construction of a 1 story service station. Estimated cost $50,000.

Mich., East Lansing — Board of Trustees, Michigan State College, awarded contract for addition to engineering school. Estimated cost $100,000.

N. J., Hasbrouck Heights—Board of Education, Administration Bldg., is having sketches made for the construction of a 2 story addition to Euclid grade school including manual training rooms, etc. Estimated cost $150,000. Architect not selected.

N. J., Little Falls—Little Falls Laundry Co., Main St., is having preliminary plans prepared for a 2 story, 140 x 280 ft. garage and 1 story, 65 x 85 ft. laundry plant on Main St. Estimated cost $150,000. Architect not announced.

N. J. Montclair—W. L. Walker, 190 Gates Ave., will build a 2 story garage building. Estimated cost $150,000. Private plans. Work will be done by separate contracts.

N. J., Union City—Owner, c/o J. G. Helmers, 147 Summit Ave., Archt., is having preliminary plans prepared for a 2 story garage building. Estimated cost $150,000.

N. J., West Orange — Board of Education, Northfield Ave., will receive bids until November 10 for a 3 story junior high school to include general shop room, printing shop, etc., on Gilbert St. Estimated cost $550,000. Hacker & Hacker, 201 Main Street, Fort Lee, Archts. Noted May 28.

N. Y., Syracuse—Board of Contract & Supply, City Hall, awarded general contract for a 3 story junior high school, including manual training department. $660,225.

O., Columbus—State Highway Department, O. W. Merrell, Dir., plans under way for addition to engineering experiment station at Ohio State University for state highway testing laboratories. Estimated cost $80,000.

O., Sandusky—Universal Pipe Co., plans the construction of a 1 story factory for the manufacture of metal piping. Estimated cost $40,000. Private plans.

R. I., Bristol—Herreshoff Mfg. Co., 13 Burnside St., c/o E. M. Corbett, 49 Purchase St., Fall River, Mass., Archt., manufacturers of yachts, postponed construction of 2 story plant here. Maturity Spring 1932. Noted Sept. 24.

Tenn., Cookeville — Board of Education, awarded contract for a new central high school to include manual training department, etc. Estimated cost $175,000.

Tex., Duncan Field—A. W. Parker, Constructing Quartermaster Randolph Field, San Antonio, awarded steel contract for 1 story, 450 x 560 ft. engineering shop, dope house, dope storage warehouse, etc. here. Noted October 22.

Wyo., Demmerer—State Highway Commission, Capitol Bldg., Cheyenne, awarded contract for a 1 story, 42 x 124 ft. shop building here. $18,980. Noted October 22.

Ont., Welland—American Manganese Steel Co., 333 North Michigan Ave., Chicago, Ill., awarded contract for rebuilding furnaces and installation of additional equipment on Burgar St. here. Noted September 3.

Equipment Wanted

Calif., San Diego—Bureau of Supplies & Accounts, Navy Department, Washington, D. C. —will receive bids until Nof. 17 for one motor driven bolt threading machine for Navy Yard here. Sched. 6810.

D. C., Washington—Bureau of Supplies & Accounts, Navy Department—will receive bids until November 17 for one motor driven selective geared head engine lathe for Navy Yard, New York, N. Y., or San Francisco, Calif. Sched. 6812.

D. C., Washington—General Purchasing Officer of Panama Canal—will receive bids until November 10 for steel drills, files, forges, turnbuckles, blowers, etc.

Ill., Rock Island—U. S. Engineer Office—will receive bids until December 18 for one locomotive crane and one bridge crane unit in connection with Lock and Dam No. 15, on Mississippi River.

Mass., Billerica—Middlesex County Commissioners, Court House, East Cambridge—will receive bids until Nov. 10 for tools and equipment, including turning lathe, ball bearing surface planer, band saws, saw bench, etc., for machine shop at House of Correction here.

N. H., Portsmouth—Bureau of Supplies & Accounts, Navy Department, Washington, D. C. —will receive bids until November 10 for one core-making machine, air operated for Navy Yard here. Sched. 6826.

N. Y., Brooklyn—Bureau of Supplies & Accounts, Navy Department, Washington, D. C. —will receive bids until November 10 for four motor driven engine lathes for Navy Yard here. Sched. 6805.

N. Y., New York—Bureau of Supplies & Accounts, Navy Department, Washington, D. C. —will receive bids until November 10 for one motor driven woodworking machine for Navy Yard here. Sched. 6833.

S. C., Charleston—Bureau of Supplies & Accounts, Navy Department, Washington, D. C. —will receive bids until November 10 for three motor driven engine lathes and one turret and one draw-in chuck for Navy Yard here. Sched. 6806.

N. Z., Wellington—Dept. of Public Works, Supply & Tenders Committee—will receive bids until January 26, for supply of one 25 ton overhead traveling double girder crane.

You Can Reach Them All
through the
SEARCHLIGHT SECTION
(on pages 94-95)
Searchlight advertisements are quick acting. They usually bring prompt returns. There is no better way to reach the men of the machinery field at small cost.

The Buyer—
The Employer—
The Agent—
The Seller—
The Employee—
The Dealer—

For Every Business Want *"Think* SEARCHLIGHT *First"*